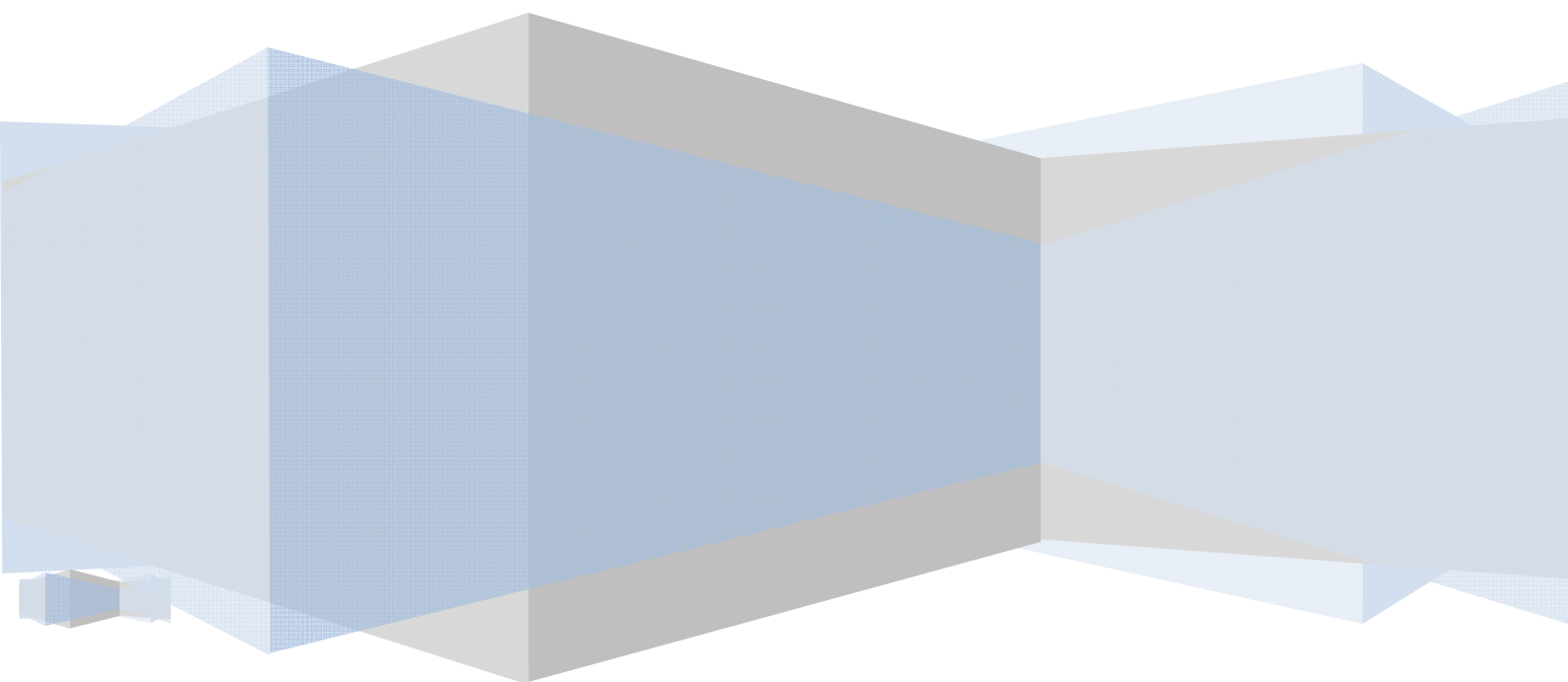


School Certificate - Science

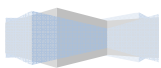
Student Summary Book – Part 1

Cherine Spirou



School Certificate – Science

- 1) Acids and Bases
- 2) Atoms
- 3) Earth's Crust
- 4) Ecosystems
- 5) Electricity
- 6) Electromagnetic Radiation, Light and the Universe
- 7) Energy Resources
- 8) Genetics and Evolution
- 9) Human Body
- 10) Motion
- 11) Chemical Reactions



ACIDS and BASES

Definition of an Acid:

Acids contain the element **hydrogen (H)** in combination with other non – metal elements.

For example:

Hydrochloric Acid (HCl)	contains hydrogen in combination with Chlorine.
Sulfuric Acid (H ₂ SO ₄)	contains hydrogen in combination with the sulfate ion (SO ₄ ²⁻)

When an acid is placed in water, the hydrogen breaks away from the other elements.

Strong or Weak Acids

With **strong acids**, the hydrogen breaks away very easily. **Weak acids** tend to hold onto their hydrogen, and very little hydrogen breaks away.

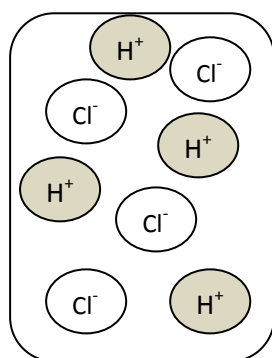
Strong acids are **corrosive** and will destroy living tissue and ‘eat through’ some surfaces.

Examples of strong acids:

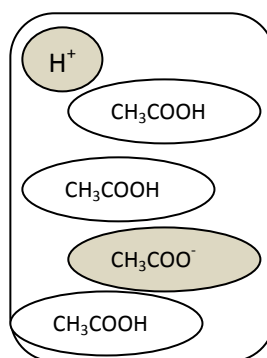
- ☺ Hydrochloric Acid (HCl)
- ☺ Nitric Acid (HNO₃)
- ☺ Sulfuric Acid (H₂SO₄)

Examples of weak acids:

- ☺ Citric Acid
- ☺ Acetic Acid (vinegar)



Strong Acid



Weak Acid

Properties of Acids

- ☺ Have a sour taste
- ☺ Turn blue litmus red
- ☺ Conduct electricity in aqueous (water) solution
- ☺

Concentration of Acids

Acids can also be **dilute** or **concentrated**.

Dilute acids: large volume of solvent compared to the solute.

Concentrated Acids: large amount of solute compared to the solvent.

Uses of Acids

Acid	Common Name	Common use
Acetylsalicylic Acid	Aspirin	Pain reliever
Sulfuric Acid	Battery Acid	Car batteries
Ascorbic Acid	Vitamin C	Antioxidant, vitamins
Hydrochloric Acid	Spirit of salts	Brick cleaners
Ethanoic Acid	Vinegar	Flavour and preserving food

BASES

Bases are chemicals that are “opposite” to acids. Bases react with acids to produce water and other substances. Any reaction of an acid with a base is called **neutralisation**.

Strong and Weak Bases

Strong bases, like strong acids, attack living tissue and cause serious burns. They react differently to skin than acids do, so while strong acids are corrosive, we say that strong bases are **caustic**. Bases may also be weak, (e.g. ammonia used for cleaning)

Bases that dissolve in water are called **alkalis**.

Properties of Bases

- ☺ Taste bitter
- ☺ Have a soapy feel
- ☺ Turn red litmus blue

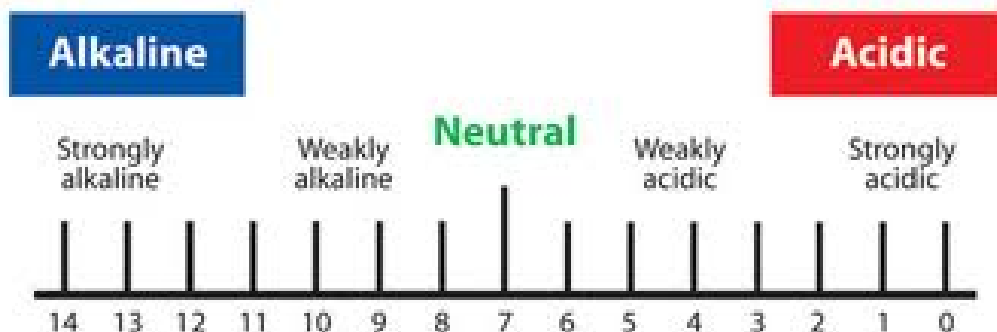
Uses of Bases

Base	Common Name	Common Use
Sodium hydroxide	Caustic Soda	Cleaning ovens
Calcium hydroxide	Slaked Lime	Reducing soil acidity
Ammonium hydroxide	“Cleaning” Ammonia	Cleaning products
Sodium hydrogen carbonate	Baking soda; Bicarbonate soda	Cooking
Sodium carbonate	Washing soda	Washing powders

Indicators and pH

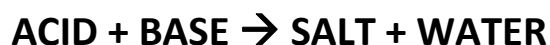
Indicators are special dyes that are used to identify acidic, basic and neutral substances. The pH scale is used to identify strong and weak acids and bases.

The pH Scale



Neutralisation Reactions

In a **neutralisation reaction**, an acid reacts with a base to produce salt and water



Example:

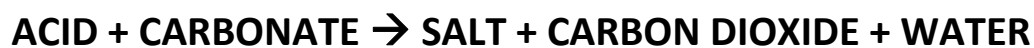
Hydrochloric Acid + Sodium Hydroxide \rightarrow Sodium Chloride + Water

Two common uses of neutralisation reactions are as follows:

- ☺ Bee stings contain acid and so they are treated with bicarbonate of soda because it contains a base that neutralises the acid.
- ☺ Wasp stings contain a base so they are treated with vinegar because it contains an acid that neutralises the base.

Acid + Carbonate Reactions

When an acid reacts with a carbonate, it produces salt, carbon dioxide and water.



Example:

Sulfuric Acid + Calcium carbonate \rightarrow Calcium Sulfate + Carbon dioxide + Water

5

Limestone caves are formed when acidic rainwater seeps underground and dissolves limestone rocks.

Acid + Metal Reactions

When an acid reacts with a metal, the reaction observed is fizzing. This is due to hydrogen gas being given off. It also produces a salt.



Example:

Hydrochloric Acid + Sodium → Sodium Chloride + Hydrogen gas

CORROSION

When a metal, corrodes it changes from a pure metal to a compound. Most metals change into metal oxides. Corrosion of iron is called rusting and it causes iron to change into iron oxide. Other corrosion reactions are:

- ☺ aluminium + oxygen → aluminium oxide
- ☺ zinc + oxygen → zinc oxide

Metals are commonly protected from corrosion by placing them in contact with another metal that corrodes instead. For example, iron ship hulls are protected from rusting by placing zinc blocks on them so that the zinc corrodes in place of the iron.

Revision Questions:

- 1) Define both acids and bases
- 2) What are the properties of both acids and bases?
- 3) What is an indicator used for?
- 4) If a substance has a pH of 9, is it acidic or alkaline?
- 5) Write the chemical formula for the following common acids/bases
 - i) Hydrochloric Acid
 - ii) Sulfuric Acid
 - iii) Ammonia
- 6) Write the word equation for the following:
 - i) Acid + metal →
 - ii) Acid + carbonate →
 - iii) Nitric Acid + Magnesium →
 - iv) Sulfuric Acid + calcium hydroxide →
 - v) Hydrochloric Acid + Aluminium carbonate →
- 7) What happens in a corrosion reaction?
- 8) Complete the following corrosion word equation
Magnesium + Oxygen →

PAST SCHOOL CERTIFICATE QUESTIONS ON ACIDS AND BASES

School Certificate 2010

1) Multiple Choice

- i) A neutralisation reaction will produce a salt and what other substance?
- (A) A base
(B) Hydrogen
(C) Oxygen
(D) Water

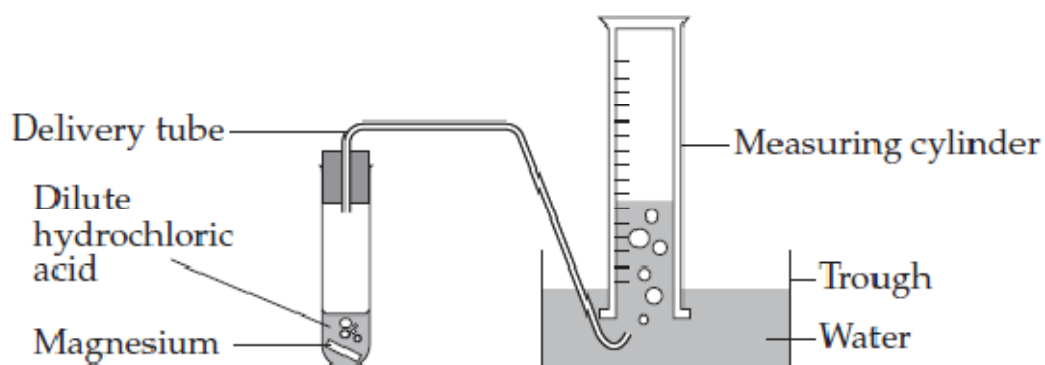
2) One – Word Answers

- i) Blue litmus paper turns red when placed in an acid. Red litmus paper turns blue when placed in a base.

What do we call chemicals like litmus paper?

3) Short Answer Questions

A science class performed an experiment as shown in the diagram to investigate the reaction between dilute hydrochloric acid and magnesium.



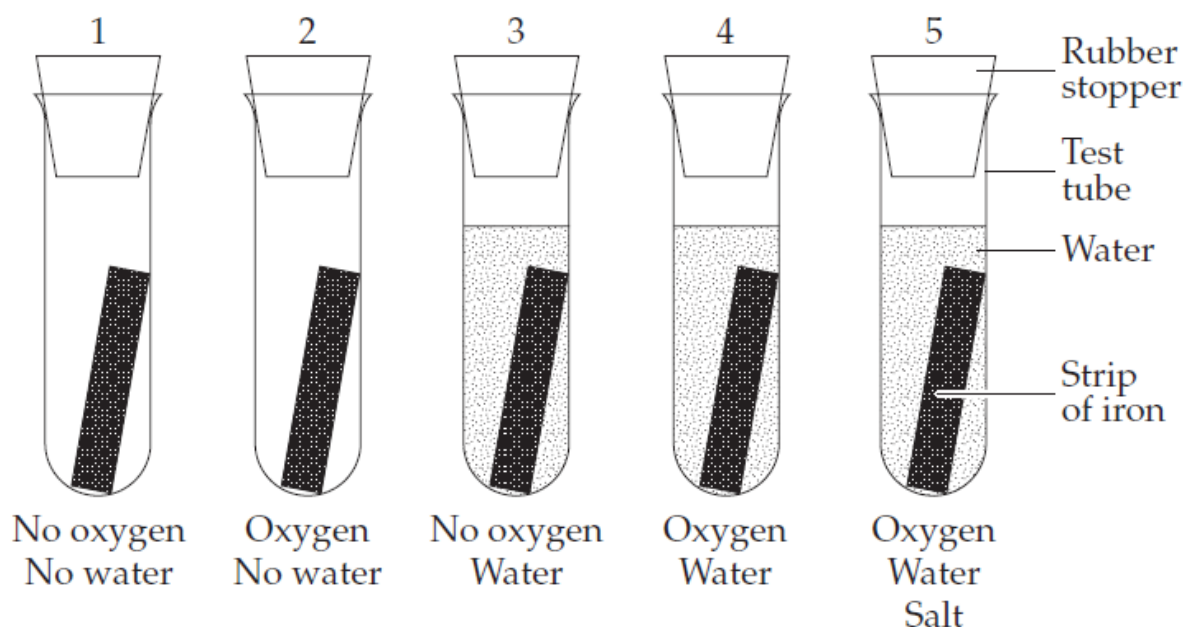
- i) Explain ONE safety procedure that the students would need to follow when carrying out this experiment.
- ii) During the reaction, a gas is produced.

What are TWO other observations the students could make during this experiment?

- iii) Name the gas that would be produced if the experiment were repeated using magnesium carbonate instead of magnesium.

1) **Multiple Choice**

Some students carried out an experiment to determine what causes iron to rust. The students placed iron into test tubes with different conditions and then sealed them. The amount of rust formed was measured.



i) Which test tubes will show if water by itself will cause rusting?

- A) 1 and 3
- B) 2 and 3
- C) 3 and 4
- D) 1, 3 and 4

ii) What type of chemical reaction is rusting?

- A) Corrosion
- B) Decomposition
- C) Neutralisation
- D) Precipitation

2) **One word answers**

i) Name the element that is present in both hydrochloric acid and sulphuric acid.

ii) What is the name of the group of substances that are used to determine if a substance is acidic or basic?

School Certificate 2008

1) **Multiple Choice**

- i) The human stomach contains acid. Sodium bicarbonate (NaHCO_3) is often found as a component of antacids, which are used to settle upset stomachs. It reacts in a similar way to normal carbonates, causing people to burp.

Why does sodium bicarbonate make people burp?

- (A) It produces hydrogen gas.
(B) It solidifies in the stomach.
(C) It produces carbon dioxide gas.
(D) It settles on top of the stomach contents.
- ii) What is an example of a neutralisation reaction?
- (A) Sodium hydroxide + hydrochloric acid \rightarrow sodium chloride + water
(B) Calcium carbonate \rightarrow calcium oxide + carbon dioxide
(C) Lead nitrate + potassium iodide \rightarrow lead iodide + potassium nitrate
(D) Methane + oxygen \rightarrow carbon dioxide + water
- iii) A student was studying chemicals found in the kitchen and noted that tea and coffee are both clear brown fluids. If lemon juice is added to both, the tea turns an orange colour but the coffee does not.

Based on these results, which conclusion is correct?

- (A) Tea acts as an indicator.
(B) Coffee acts as an indicator.
(C) Both tea and coffee act as indicators.
(D) Neither tea nor coffee acts as an indicator.

School Certificate 2006

1) **Multiple Choice**

- i) What can indicators identify in chemical reactions?
- (A) The presence of a metal
(B) Changes in acid solutions
(C) The presence of a precipitate
(D) The reactants and products of a reaction

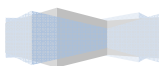
School Certificate 2005

1) Multiple Choice

- i) Most vegetables grow best in soils that are slightly acidic. Casey wanted to see if her soil was suitable for growing vegetables. How would she best determine the acidity of her soil?
- (A) Taste the soil.
(B) Dissolve the soil in water.
(C) Check the colour of the soil.
(D) Use an indicator on the soil.
- ii) When an acid reacts with a carbonate, the products are water, salt and a gas. What is the name of this gas?
- (A) Carbon dioxide
(B) Carbon monoxide
(C) Hydrogen
(D) Oxygen
- iii) A reaction occurs when a piece of zinc is added to hydrochloric acid. Which of the following is a product of this reaction?
- (A) Carbon dioxide
(B) Hydrogen
(C) Oxygen
(D) Water

2) One word Answers

- i) Which acid is known by the chemical formula, H_2SO_4 ?



1) Multiple Choice

i) What is the chemical formula for sulfuric acid?

- (A) H_2SO_4
- (B) HS_4O
- (C) H_4SO_2
- (D) $\text{HS}(\text{OH})_4$

Use this information to answer Questions ii) and iii)



ii) What does X represent in this equation?

- (A) carbon dioxide
- (B) calcium sulfate
- (C) hydrogen
- (D) sulfuric hydroxide

iii) What is the name of this type of chemical reaction?

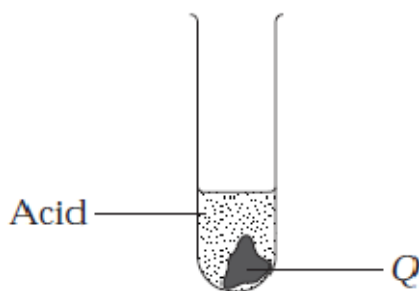
- (A) Combustion
- (B) Corrosion
- (C) Decomposition
- (D) Neutralisation

2) One Word Answers

i) What type of chemical reaction is the rusting of iron?

3) Short Answer Questions

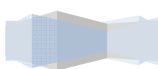
The diagram shows a test tube containing an acid. A piece of substance Q is added.



- i) Q is a shiny-grey substance that can conduct electricity. What type of substance is Q?
- (b)
 - (i) Identify ONE risk in this experiment.
 - (ii) Describe ONE safety precaution that would reduce this risk.
 - (c) What are THREE observations that could be made when the acid begins to react with substance Q?

Glossary

Acid, Alkali, Base, Neutralisation, Corrosion, Concentrated, Dilute, Weak, Strong, indicator, pH scale



ATOMS

Structure of an Atom

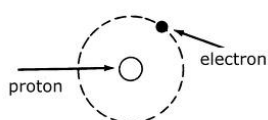
The structure of the atom comprises of the following:

- ☺ Nucleus
- ☺ Electron Shells

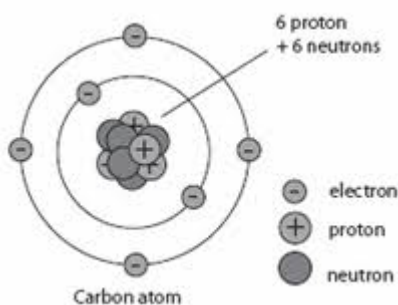
The atom also consists of **subatomic particles**.

These are:

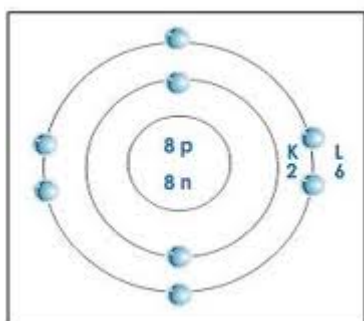
- ☺ Protons - found in the nucleus and have a **positive charge**
- ☺ Neutrons - found in the nucleus and have **no charge**
- ☺ Electrons - found orbiting the nucleus and have a **negative charge**



Hydrogen atom



Carbon atom



Oxygen atom

There are more than 115 known elements. Their names and symbols can be found on the **Periodic Table**.

The elements are arranged in the Periodic Table according to **Atomic Number**. The horizontal groups are called **periods**. The vertical columns are called **groups**. Elements that are in the same group have similar elements.

The vertical columns in the Periodic Table are called groups and elements in the same group have similar properties.

- ☺ Group 1 elements (Li, Na, K) are called the **alkaline** metals. They are all metals and solids at room temperature. They all have one electron in the outer electron orbit and form ions with a charge of +1. They react with water.
- ☺ Group 2 elements (Be, Mg, Ca) are called the **alkaline earth** metals. They are all metals and are solids at room temperature. They all have two electrons in the outer electron orbit and form ions with a charge of +2. They react with acid.
- ☺ Group 7 elements (F, Cl, Br, I) are called the **halogens**. They are all metals and are solids, liquids and gases at room temperature. They form ions with a charge of -1.
- ☺ Group 8 elements (He, Ne, Ar) are called the **inert gases or noble gases**. They are all non-metals and are gases at room temperature. They have a full outer electron orbit and so do not react with other elements

Atomic Number

An element's atomic number represents the **number of protons/electrons** in an atom.

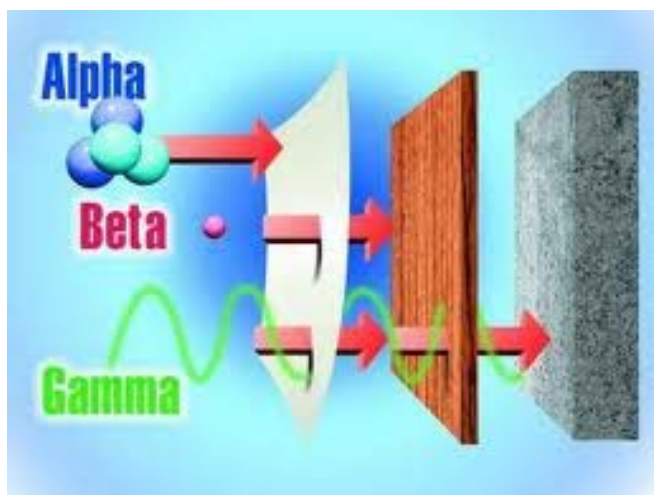
Atomic Mass

An element's atomic mass is determined by the **atomic mass – no. of neutrons**.

Radioisotopes and Radiation

Radioisotopes are elements emit radioactive radiation. There are three types of radioactive radiation:

- ☺ Gamma rays – high frequency, high energy electromagnetic waves that are the most penetrating and most dangerous type of radiation. This energy is also called nuclear energy as it comes from the nucleus of atoms.
- ☺ Beta particles – fast moving streams of electrons
- ☺ Alpha particles – positively charged helium nuclei that are the least penetrating type of radiation.



The half-life of a radioisotope is the time taken for half of the atoms to radioactively decay. Some radioisotopes such as uranium are dangerous because they have a long half-life which means that they emit radiation for a long period of time.

Uses of Radioisotopes

Radioisotopes are radioactive forms of elements. They have many uses in medicine and industry.

They are used widely in medicine to kill cancerous tumours. When exposed to nuclear radiation, the DNA in the cancerous cells of a tumour is damaged which causes the cells to self-destruct and so the tumour is destroyed.

Radioisotopes are also used in medicine for medical diagnosis. They are injected into the body and transported by the blood to all parts of the body where they are detected by gamma cameras to provide images of the heart, brain and other organs. These images then allow doctors to diagnose and treat illnesses.

Radioisotopes are used in industry to detect problems with equipment. They are added to liquids and gases flowing in pipes and then traced to look for leaks in the pipes. Such leaks show up fractures in the pipes which, once repaired, reduce the risk of larger damage to the pipes and surrounding structures and so lead to increased profits for industry.

While there are many benefits associated with the use of radioisotopes, there are also concerns, in particular, the damage caused due to contamination by radioactive waste. Radioisotopes must be prepared, transported and disposed of safely to avoid accidents that release them into the environment. Contamination by such accidents seriously harms living things and the environment in both the short term and the long term.

COMPOUNDS

A compound is a substance made from two different elements joined together. New compounds are made by rearranging atoms from existing elements and compounds. Every compound has a chemical formula that shows the types and numbers of atoms in the compound.

Common Compounds

Name	Formula
Hydrochloric Acid	HCl
Sulfuric Acid	H ₂ SO ₄
Sodium Chloride	NaCl
Ammonia	NH ₃
Calcium carbonate	CaCO ₃
Nitric Acid	HNO ₃

Symbols For Elements, Compounds, Atoms And Molecules

Symbols can be used to represent atoms, elements, compounds and molecules.

- An atom is the smallest particle of matter. It is represented by a single shape.



- An element is a substance that is made of only one type of atom; it cannot be decomposed. It is represented by a single shape or two of the same shape joined together.



- A compound is a substance that is made of two or more different types of atoms joined together. It is represented by two or more different shapes joined together.



- A molecule is a substance that contains two or more atoms joined together. Some molecules are elements (same atoms joined together) and are represented by two of the same molecule joined together eg. H₂. Other molecules are compounds (different atoms joined together) and are represented by two or more different shapes joined together.



Decomposition Reactions

In a decomposition reaction, a compound is broken down into its elements, eg. water can be decomposed into hydrogen and oxygen by passing an electric current through it.



Precipitation Reactions

In a precipitation reaction, two solutions are mixed together to produce an insoluble solid called a precipitate, eg.



Revision QUESTIONS

1. What is an atom?
2. What is the difference between an atom and a molecule?
3. Draw a labelled diagram of an atom showing the location and features of protons, neutrons and electrons.
4. In the Periodic Table, what is the name given to the
a) columns b) rows?
5. What information about elements is contained in the Periodic Table?
6. What is the name given to the elements in group 8?
7. What are the names of the three types of radioactive radiation emitted from the nuclei of radioactive elements? Which ones are the most penetrating?
8. Explain why radioisotopes that have a long half-life are dangerous.
9. Describe two uses of radioisotopes.
10. Describe a problem associated with the use of radioisotopes.
11. What information about a compound is contained in its chemical formula?
12. What is the chemical formula for hydrochloric acid, sodium hydroxide and sodium chloride?
13. How are new compounds formed?
14. What happens in a decomposition reaction?
15. What is a precipitate?

PAST SCHOOL CERTIFICATE QUESTIONS ON ATOMS

School Certificate 2010

1) Multiple Choice

- i) The diagram is a model of a chemical substance. What does the model represent?
- (A) An atom of a compound
(B) An atom of an element
(C) A molecule of a compound
(D) A molecule of an element

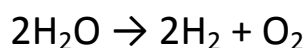
The table shows the number of protons and neutrons in four atoms, W, X, Y and Z.

<i>Atom</i>	<i>Number of protons</i>	<i>Number of neutrons</i>
W	6	6
X	6	7
Y	7	7
Z	7	6

- ii) Which of the following correctly identifies atoms that are from different elements, and the evidence for this?

	<i>These atoms are from different elements</i>	<i>Evidence</i>
(A)	W and X	neutrons
(B)	Y and Z	protons
(C)	W and Y	neutrons
(D)	X and Z	protons

- iii) During the electrolysis of water the gases hydrogen and oxygen are produced. The equation for this reaction is shown.



What type of reaction is this?

- (A) Oxidation
(B) Combustion
(C) Neutralisation
(D) Decomposition

The molecular formula for aspartame is $C_{14}H_{18}N_2O_5$.

iv) What does this formula tell us about one molecule of aspartame?

- (A) It is made up of 39 atoms.
- (B) It is made up of four atoms.
- (C) It is made up of four compounds.
- (D) It contains more nitrogen atoms than oxygen atoms

A precipitation reaction occurs when two substances that are dissolved in water react and form a substance that does not dissolve in water. This substance is called a precipitate. The table shows which dissolved substances form a precipitate when combined. These substances exist as dissolved ions.

	<i>Chloride</i>	<i>Hydroxide</i>	<i>Nitrate</i>	<i>Carbonate</i>
<i>Sodium</i>	X	X	X	X
<i>Magnesium</i>	X	X	X	P
<i>Calcium</i>	X	X	X	P
<i>Lead</i>	X	P	X	P
<i>Silver</i>	P	P	X	P

Key X – No precipitate P – Precipitate formed

v) Which of the following substances does NOT dissolve in water?

- (A) Lead nitrate
- (B) Magnesium hydroxide
- (C) Silver carbonate
- (D) Sodium chloride

vi) What is the chemical formula of calcium carbonate?

- (A) CCO_3
- (B) $CaCO_3$
- (C) Ca_3CO
- (D) $CaCO_2$

2) One word Answers

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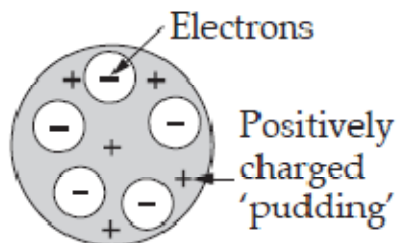
Name the part of the atom that contains protons and neutrons.

3) Short Answer Questions

The diagrams represent models that were used at different times in the past to describe features of atoms.



John Dalton's
Model (1803)



JJ Thomson's
Model (1904)

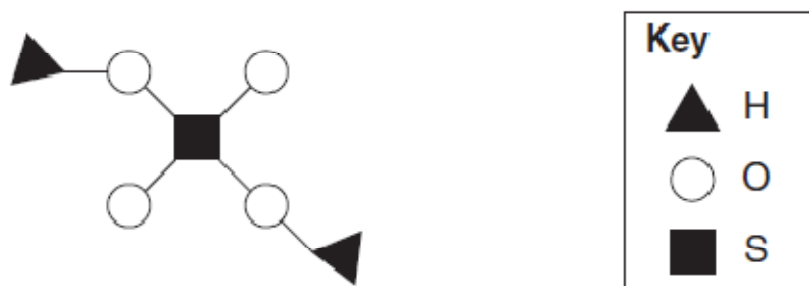
- (a) Suggest a reason why models change over time.
- (b) Outline the limitations of using models in science.
- (c) Draw a labelled diagram of a model that we use now to represent atomic structure.

1) Multiple Choice

- i) What is the smallest unit of an element?
- (A) An atom
 - (B) An electron
 - (C) A neutron
 - (D) A proton
- ii) What does the word *combustion* refer to?
- (A) The burning of a compound in oxygen
 - (B) A reaction that involves heat and smoke
 - (C) A reaction that involves hot acids and bases
 - (D) The flames that result when something burns

The chemical formula for limestone is CaCO_3

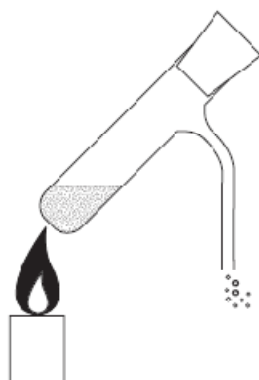
- iii) What information does the chemical formula give us?
- (A) The type of atoms in the compound
 - (B) The size and mass of the compound
 - (C) The common name of the compound
 - (D) The arrangement of the atoms in the compound
- iv) What is the chemical formula for carbon dioxide?
- (A) CO^2
 - (B) CO
 - (C) C_2O
 - (D) CO_2



The diagram shows a chemical compound

- v) What is the chemical formula of the compound?
- (A) S_2OH
 (B) H_4OS_2
 (C) H_2SO_4
 (D) OH_2S_4
- vi) Which element is represented by the symbol ▲?
- (A) Halogen
 (B) Helium
 (C) Hydrogen
 (D) Hydroxide

A student heated some copper carbonate in a test tube as shown.



The student wrote the following notes in their note book.

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- 1 The solid changed colour from green to black.
- 2 Carbonates release carbon dioxide gas when heated.
- 3 The gas collected turned limewater a milky colour.
- 4 The black solid must be carbon.

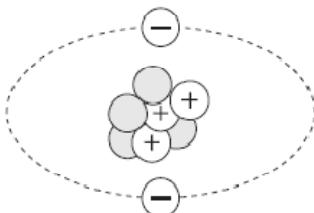
- vii) Why is the reaction called a decomposition reaction?
- (A) Heat is required.
 - (B) Carbon dioxide is produced.
 - (C) Two substances combine to form a larger molecule.
 - (D) One reactant breaks down into two or more products.

This key can be used to identify particles

Key:

- | | | |
|---|--|----------|
| 1 | (a) Has 1 nucleus | go to 2 |
| | (b) Has 2 nuclei | Molecule |
| 2 | (a) Has equal numbers of protons and electrons | Atom |
| | (b) Has different numbers of protons and electrons | go to 3 |
| 3 | (a) Has more electrons than protons | Anion |
| | (b) Has more protons than electrons | Cation |

A diagram shows an unidentified particle.



- viii) Using the key, what sort of particle is shown?
- (A) Anion
 - (B) Atom
 - (C) Cation
 - (D) Molecule

1) Multiple Choice

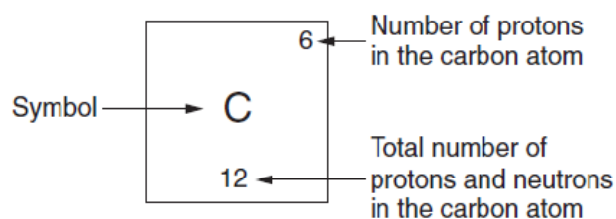
- i) Where are protons and neutrons located in an atom?
- (A) In the nucleus
(B) As part of the electron cloud
(C) As a pair attached to electrons
(D) Distributed equally throughout the atom
- ii) The burning of coal in power stations produces carbon dioxide.
Which chemical reaction produces the carbon dioxide?
- (A) Acidification
(B) Combustion
(C) Decomposition
(D) Neutralisation
- iii) What occurs when a new compound is formed?
- (A) Atoms are lost.
(B) Energy is destroyed.
(C) New matter is created.
(D) Atoms are rearranged.

Use the following information to answer the next three questions.

The table represents part of a row of a simplified Periodic Table.

5	6	7	8	9	10
B	C	N	O	F	Ne
11	12	14	16	19	20

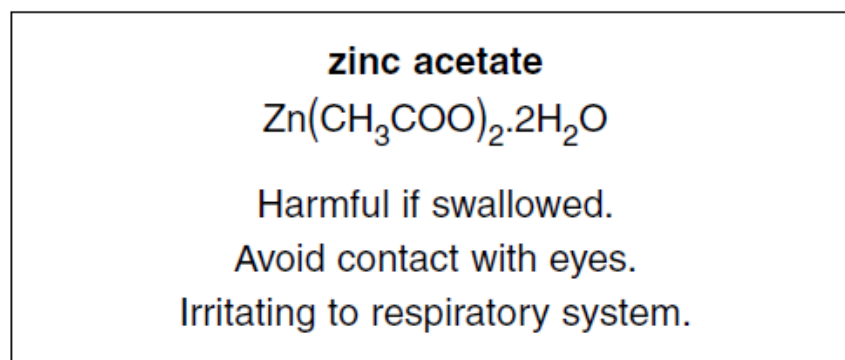
The following information can be gathered from the table.



- iv) How many protons are in the atom of oxygen (O) shown?
- (A) 6
(B) 8
(C) 16
(D) 24
- v) How many neutrons are in the atom of fluorine (F) shown?
- (A) 9
(B) 10
(C) 19
(D) 28
- vi) On what basis are elements arranged from left to right across a row of the Periodic Table?
- (A) The atoms gain a proton.
(B) The atoms lose two protons.
(C) The atoms lose a neutron.
(D) The atoms gain two neutrons.

Use the information below to answer the following question

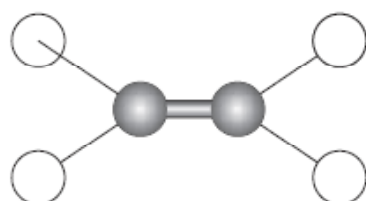
This label appeared on a bottle of zinc acetate.





-
- vii) Which elements make up zinc acetate?
- (A) zinc and acetate
(B) zinc, acetate and water
(C) zinc, carbon, hydrogen and oxygen
(D) zinc, carbon, helium, oxygen and water

1) *Multiple Choice*

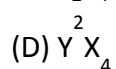
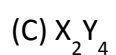
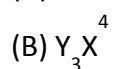
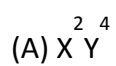
The diagram represents a molecule.



KEY

Symbol	Atom
	X
	Y

i) Which is the correct chemical formula of this molecule?



The table shows information about four atoms, but some of the information is missing.

	<i>Protons</i>	<i>Neutrons</i>	<i>Electrons</i>
W	6	7	—
X	7	7	—
Y	—	8	6
Z	—	8	8

— missing information

ii) Which two atoms are of the same element?

(A) W and Y

(B) W and X

(C) Y and Z

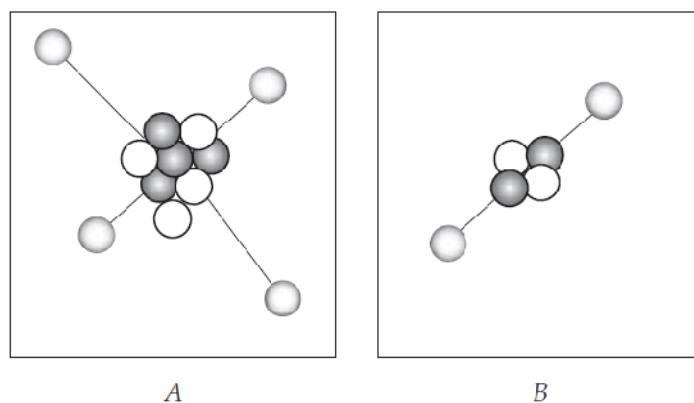
(D) Y and X

Use the following information to answer the two questions below.

Adrenaline is a chemical substance that is secreted into the bloodstream by the adrenal glands in our body. Adrenaline acts as a chemical messenger involved in coordination. The chemical formula of adrenaline is $C_9H_{13}NO_3$.

- iii) What term best describes this substance?
- (A) Hazardous
 - (B) Hormone
 - (C) Inorganic
 - (D) Synthetic
- iv) How many nitrogen atoms are in an adrenaline molecule?
- (A) 0
 - (B) 1
 - (C) 3
 - (D) 13

Images, *A* and *B*, show models of two different atoms. Use the images to answer the next two questions



- v) What do the balls at the centre of each model represent?
- (A) Neutrons
 - (B) Protons
 - (C) Protons and neutrons
 - (D) Protons and electrons

vi) Why are different numbers of balls used to represent protons, neutrons and electrons in the two models?

(A) To illustrate the way electrons flow

(B) To show that no two atoms are alike

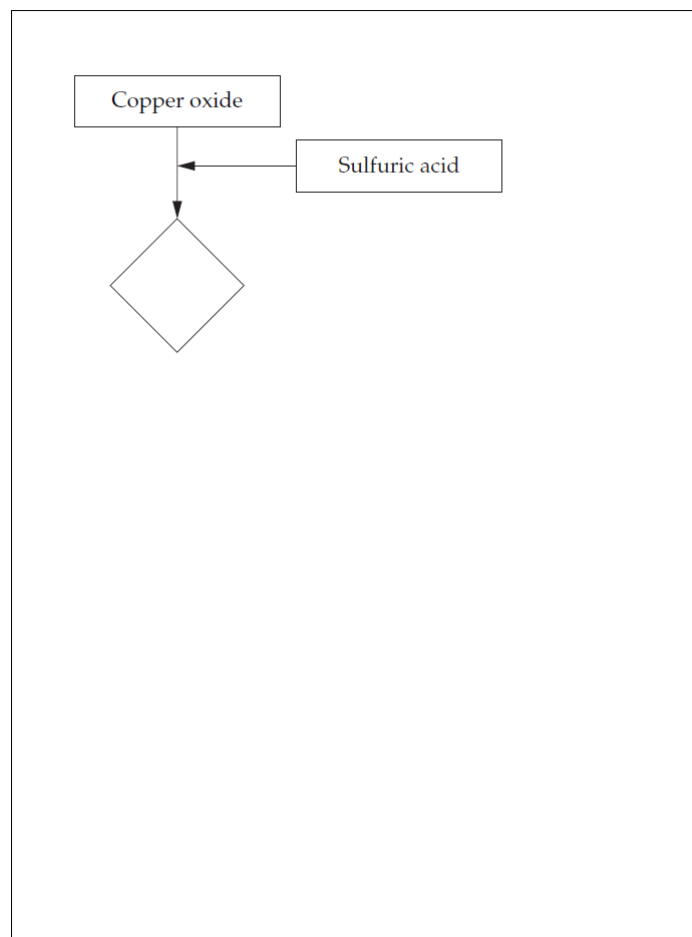
(C) To illustrate how different molecules appear

(D) To show the difference between atoms of different elements

2) *Short Answer Questions*

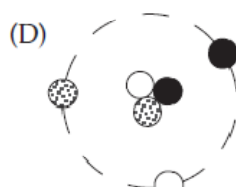
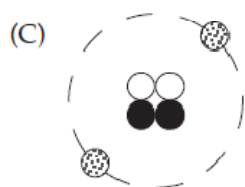
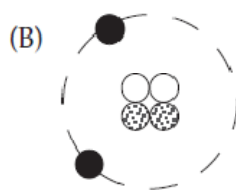
i) Write a word equation for the heating of copper carbonate shown in the flow chart.

ii) Complete the flow chart of the process used to convert copper oxide to copper metal. Use the symbols shown in the example in the Stimulus Booklet.



1) Multiple Choice

- i) Helium is an element made up of two protons, two neutrons and two electrons. Which diagram best represents helium?



KEY

	Proton
	Neutron
	Electron

- ii) Which scientist described the relationship between force, mass and acceleration in his Laws of Motion?

- (A) Charles Darwin
(B) Albert Einstein
(C) Isaac Newton
(D) James Watson

Use the following information to answer Questions iii) and iv). The diagram represents models of the nucleus of three atoms



KEY

	Neutron
	Proton

- iii) Which statement about models X, Y and Z is correct?

- (A) Model X is not a nucleus because it does not have any neutrons.
(B) None of the models of the nuclei is correct because none includes electrons.
(C) Models X, Y and Z represent three different elements because they have different numbers of neutrons.
(D) Models X, Y and Z represent nuclei of the same element because they have the same number of protons.

- iv) What is an advantage of using models like the one above to describe atoms?
- (A) Models allow theories to change over time.
 - (B) Models are an accurate representation of the actual phenomena.
 - (C) Models are used to make hypotheses about observed phenomena.
 - (D) Models are simplified representations to explain observed phenomena
- i) Chemists use a code to represent chemical compounds. For example, nitric acid is written: HNO_3 .
What is the scientific term for this code?
- (A) Chemical equation
 - (B) Chemical formula
 - (C) Chemical name
 - (D) Chemical symbol

2) *One word Answers*

What name is given to the part of an atom that has a negative charge?

3) *Short Answer Questions*

- i) A scientist uses detectors to determine if an element is radioactive.
- a) If an element is radioactive, what would be released from its nucleus?
- (b) Radioactive elements contain atoms whose nuclei can change.
Radioactive elements can be used in the field of nuclear medicine. Describe ONE benefit and ONE problem associated with the use of nuclear energy in medicine.

1) One word Answers

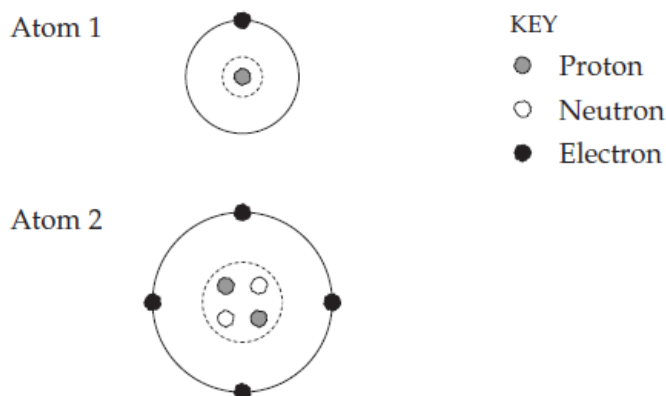
- i) What name is given to the smallest unit of an element?

1 H 1.008 Hydrogen								2 He 4.003 Helium
3 Li 6.941 Lithium	4 Be 9.012 Beryllium		5 B 10.81 Boron	6 C 12.01 Carbon	7 N 14.01 Nitrogen	8 O 16.00 Oxygen	9 F 19.00 Fluorine	10 Ne 20.18 Neon
11 Na 22.99 Sodium	12 Mg 24.31 Magnesium		13 Al 26.98 Aluminium	14 Si 32.07 Silicon	15 P 30.97 Phosphorus	16 S 32.07 Sulfur	17 Cl 35.45 Chlorine	18 Ar 39.95 Argon
19 K 39.10 Potassium	20 Ca 40.08 Calcium							

- ii) What is the chemical symbol for sodium?
- iii) Which element in the table has very similar chemical properties to fluorine?

2) Short Answer Questions

Larry drew diagrams to represent two atoms.



























- i) What information from the diagrams tells us that Larry's diagrams represent the atoms of two different elements?
- ii) Identify ONE significant error Larry has made in one of his diagrams.
- iii) Scientists often use models such as these diagrams to describe scientific phenomena. Describe ONE benefit and ONE limitation of using models

1) Multiple Choice

- i) What are the rows of the Periodic Table called?
- (A) Elements
(B) Families
(C) Groups
(D) Periods
- ii) What are molecules of an element made of?
- (A) Atoms of the same element
(B) Atoms of two different elements
(C) Atoms of the same compound
(D) Atoms of two different compounds
- iii) Which elements of the Periodic Table are the most similar in their properties?
- (A) Elements that are gases
(B) Elements across the same row
(C) Elements down the same column
(D) Elements with atomic numbers less than 20
- iv) Under certain conditions, when copper oxide is heated with carbon, the copper oxide will lose oxygen and copper will be formed. The oxygen will combine with the carbon to form carbon monoxide.

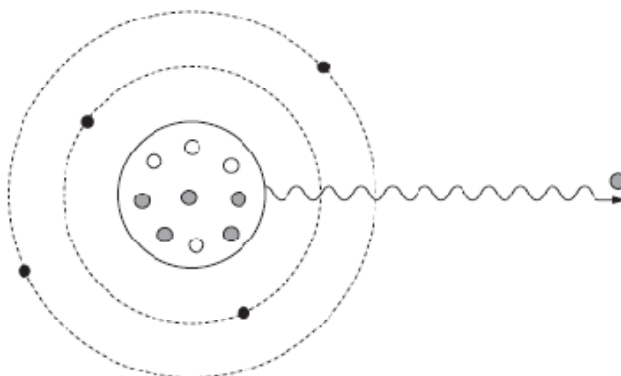


Which set of diagrams represents this reaction?

- (A) — +  → — + 
- (B) — +  →  + —
- (C) — +  →  + —
- (D) — +  → — + 

Use the diagram below to answer questions v) and vi)

The diagram represents a neutral atom with a subatomic particle being released.



- v) What type of particle has been released?
- (A) Electron
 - (B) Neutron
 - (C) Nucleus
 - (D) Proton
- vi) As the subatomic particle is released, it has kinetic energy. What was the original form of this energy?
- (A) Gravitational
 - (B) Light
 - (C) Nuclear
 - (D) Sound
- viii) Helium is a gas that is very stable and chemically inactive. What feature of helium makes it inactive?
- (A) Size of protons
 - (B) Number of neutrons
 - (C) Location of protons
 - (D) Arrangement of electrons

Glossary

Atom, Compound, Molecule, Proton, Neutron, Electron, Nucleus, Shells, Decomposition, Precipitate, Precipitation, Element, Periodic Table, Atomic Number, Atomic Mass

EARTH'S CRUST

Fossils

Fossils are the remains, impressions or traces of living things. Fossils will only form when conditions are right.

- ☺ QUICK BURIAL – The organism, its body parts (bones, shells) or its impression must be buried quickly so that it is not damaged by predators and so that it does not decay quickly.
- ☺ SUITABLE BODY PARTS – Hard body parts such as shells, bones and teeth form fossils but soft parts do not.
- ☺ UNDISTURBED ROCKS – Fossils form in sediments that are not disturbed by earth movements such as earthquakes and volcanoes. The sediments slowly harden into rocks and the fossils are kept intact.

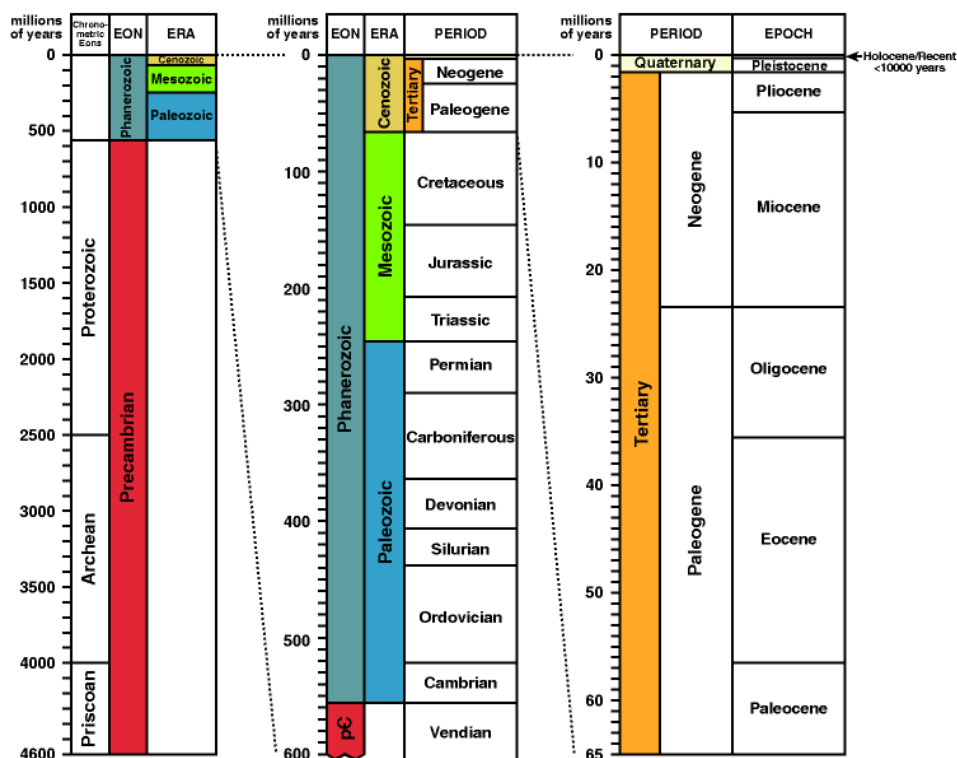
Law Of Superposition

The Law of Superposition states that in a series of rock layers the oldest rocks are at the bottom and the youngest rocks are at the top.

Correlation is the matching up of rock layers that are the same age but come from different places. They are matched by looking for the same types of rocks above and below and the same fossils.

Geological Time Scale

The Geological Time Scale shows when different types of plants and animals lived on earth. It divides the earth's history into a number of periods. The first lifeforms were simple, aquatic organisms. Since then organisms have become larger and more complex and have moved onto land.

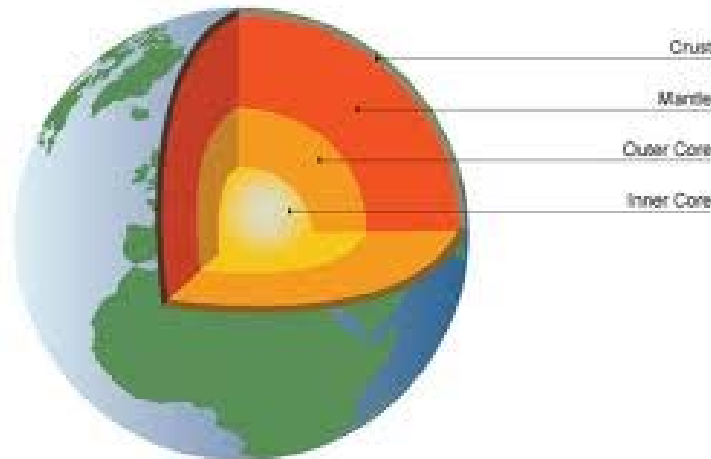


Layered Structure Of The Earth

The earth has a layered structure as shown in the diagram below.

There are several regions in the Earth's crust.

- ☺ lithosphere – the Earth's solid, rocky crust
- ☺ hydrosphere – the water on the earth's surface
- ☺ biosphere – the region of the earth's surface, that is, the land, sea and air, that is inhabited by living organisms



Continental Drift

In 1915 Alfred Wegener proposed that all of the continents were once joined together into one vast land mass called Pangaea. About 250 million years ago, Pangaea broke into two parts. Laurasia consisted of North America, Europe and Asia. Gondwana (also called Gondwanaland), consisted of South America, Africa, Australia, Antarctica and India. About 200 million years ago, the continents gradually broke apart and separated. Wegener's theory was called Continental Drift. Evidence to support his ideas:

- ☺ The shapes of the continents fit together like the pieces of a jigaw.
- ☺ Eroded mountain ranges, patterns of scouring by glaciers and deposits of iron ore all match up on different continents
- ☺ Similar limestone deposits are found in Australia, Antarctica and southern Africa.
- ☺ Fossils of *Mesosaurus*, a crocodile-like reptile, are found in southern Africa and South America.
- ☺ Fossils of an ancient plant called *Glossopteris* are found in all five continents from Gondwana but not in Europe.
- ☺ Fossils younger than 150 million years are different on all continents.

The theory of Continental drift was not widely accepted because there was explanation put forward as to how the continents drifted.



Sea Floor Spreading

In 1962, Harry Hess proposed the idea of sea floor spreading to explain how the continents drifted. He used a depth sounder to map the ocean floor and discovered huge mountain ranges down the middle of the ocean and called them mid-ocean ridges. The idea of sea floor spreading is that new crust is being made in the mid-ocean ridges. Half of the new crust goes to each side of the ridge. The growing ridge pushes the continents apart. The rock needed to make the new crust comes from the mantle.

In the 1970s, drillings into the sea floor provided supporting evidence.

- ☺ The basalt rock underlying the ocean is youngest at the ridge and gets older the further it is away from the ridge.
- ☺ Mid-ocean sediments are thinnest at the ridge and are thicker further away from the ridge.

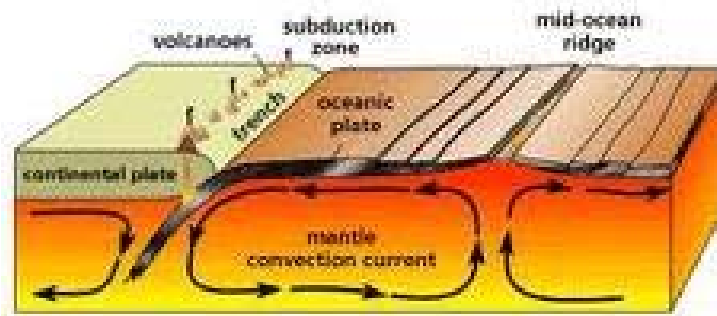
Plate Tectonics

Earth's crust is composed of large plates that move slowly over the earth's surface. The theory of Plate Tectonics explains how this occurs.

- ☺ At mid-oceanic ridges, molten rock rises up from the asthenosphere, cools to form solid rock and pushes the plates outwards. This produces new crust.
- ☺ At other plate boundaries, plates collide and produce earthquakes along with either volcanoes or fold mountains.
- ☺ At a third type of plate boundary, two plates slide past each other. The grinding action causes earthquakes, eg. movements along the San Andreas fault in California has produced earthquakes in San Francisco.

Convection Currents Cause Plate Movement

The asthenosphere is composed of magma that moves slowly in convection currents. As the magma moves, it drags the plates with it, causing them to move apart in some places and collide in other places.

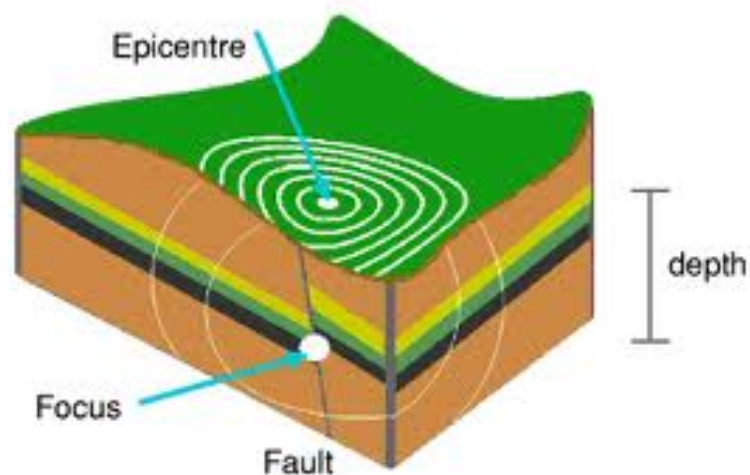


Earthquakes

The focus of an earthquake is the location in the Earth's crust where the earthquake occurred.

The epicentre is the place on the Earth's surface that is closest to the focus of the earthquake.

Energy is carried out from earthquakes by seismic waves



Impacts Of Earthquakes

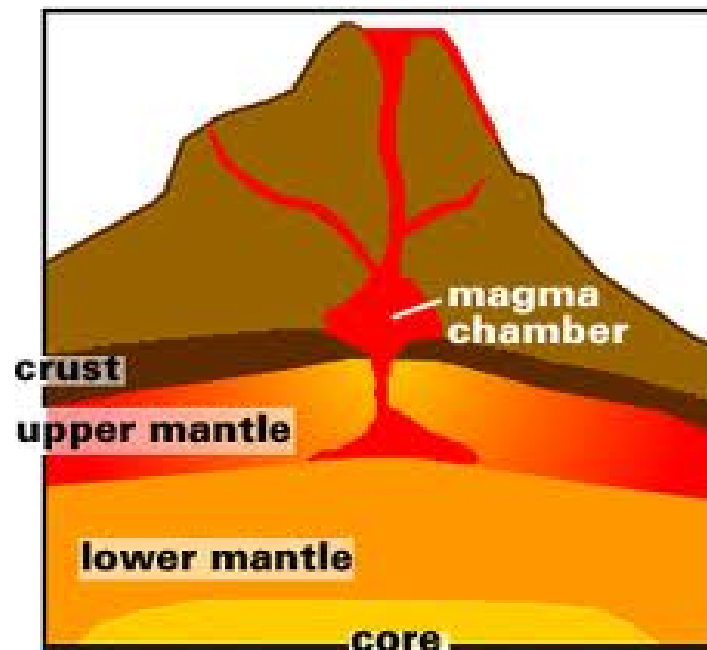
The Modified Mercalli Scale and the Richter Scale measure the impact of earthquakes. Seismic waves carry energy that causes damage to the

- ☺ lithosphere – large cracks appear in the Earth's crust
- ☺ biosphere – many living organisms are injured or killed by the damage to their environment

Impacts Of Volcanoes

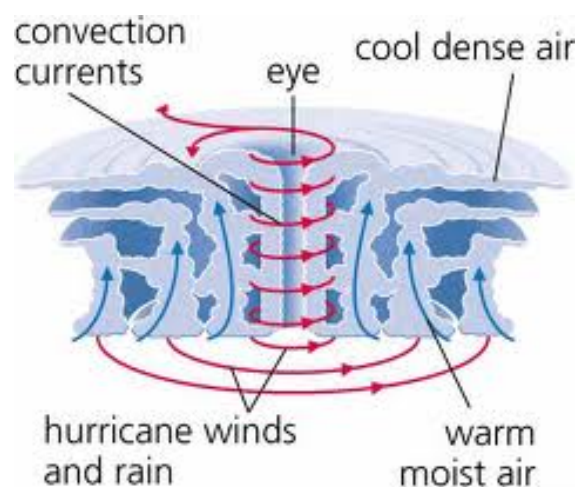
Volcanoes cause damage to the

- ☺ atmosphere – poisonous gases and hot ash contaminate the atmosphere
- ☺ hydrosphere – lava often enters the ocean from volcanoes on land or in the ocean
- ☺ lithosphere – crust is destroyed in the violent earth movements associated with volcanoes
- ☺ biosphere – lava and hot gases injure and kill living organisms



Cyclones

Cyclones are tropical storms with very high winds. They cause damage to the biosphere as the violent winds and heavy rain injure and kill living organisms.



Revision Questions

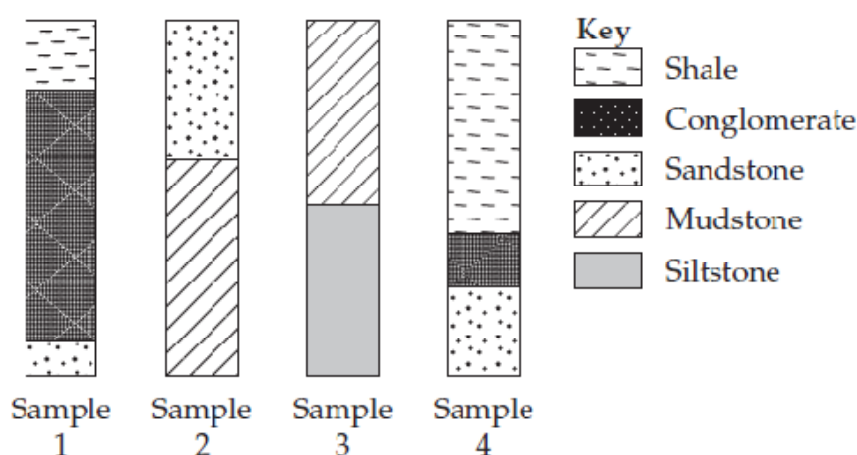
1. Describe the conditions under which fossils form.
2. In several layers of rocks which is the oldest and which is the youngest?
3. What information is contained in the Geological Time Scale?
4. Discuss one piece of evidence used by Wegener to support his theory of Continental Drift.
5. Explain how convection currents in the mantle cause crustal plates to move.
6. Explain how interactions at plate boundaries result in earthquakes, volcanoes and folded mountains.
7. What is the “epicentre” of an earthquake?
8. Explain one impact of earthquakes on the
 - a. lithosphere
 - b. biosphere
9. Explain one impact of volcanoes on the
 - a. lithosphere
 - b. atmosphere
 - c. hydrosphere
 - d. biosphere
10. Explain one impact of cyclones on the biosphere

School Certificate 2010

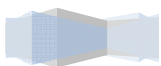
1) Multiple Choice

Use the diagram to answer questions i) – iii)

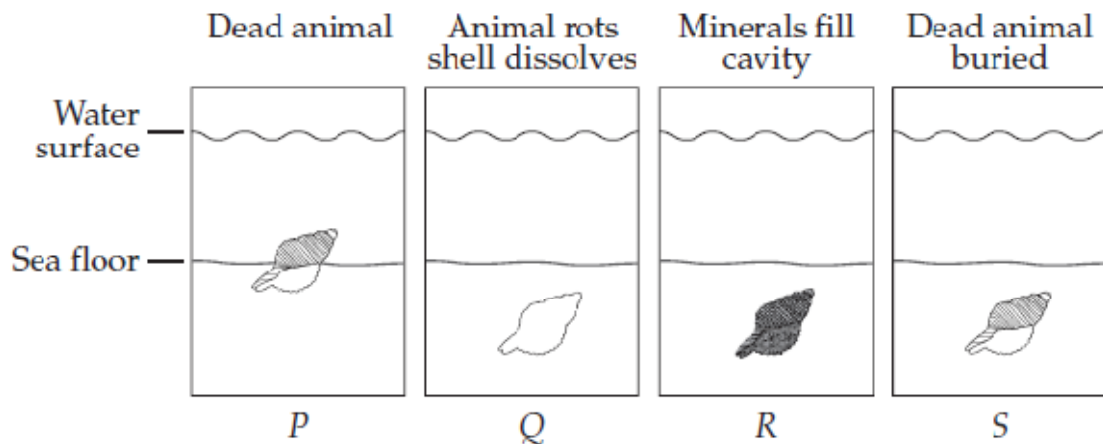
The diagrams show the sequence of rock layers in four samples obtained from the same region.



- i) What percentage of Sample 2 is made up of mudstone?
- (A) 40%
 - (B) 50%
 - (C) 54%
 - (D) 60%
- ii) What rock is most likely to be found immediately above the sandstone in Sample 2?
- (A) Conglomerate
 - (B) Mudstone
 - (C) Shale
 - (D) Siltstone
- iii) Which sample contains the oldest rock?
- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4
- iii) Which of the following causes movement of Earth's tectonic plates?
- (A) Convection currents in the mantle
 - (B) Waves travelling through the mantle
 - (C) Expansion and contraction of Earth's crust
 - (D) Earthquakes and faults occurring in the crust
- iv) Which of the following is most likely to occur as a result of two tectonic plates sliding past each other horizontally?
- (A) Convection currents
 - (B) Cyclones
 - (C) Earthquakes
 - (D) Volcanic eruption



The diagrams represent different stages in the formation of a type of fossil. The stages are not drawn in the correct sequence.



v) Which is the correct sequence of these stages?

- (A) P R Q S
- (B) P S Q R
- (C) P S R Q
- (D) P R S Q

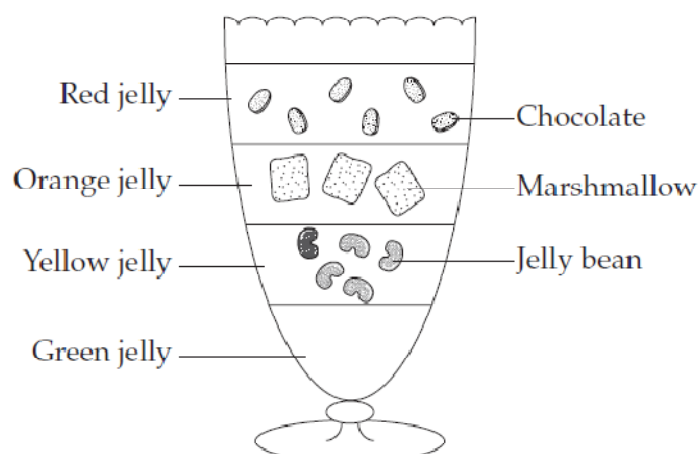
School Certificate 2009

1) **One Word Answers**

Within Earth, magma is heated causing it to rise. It then cools and sinks. What is the name given for this type of movement of magma?

2) **Short Answer Questions**

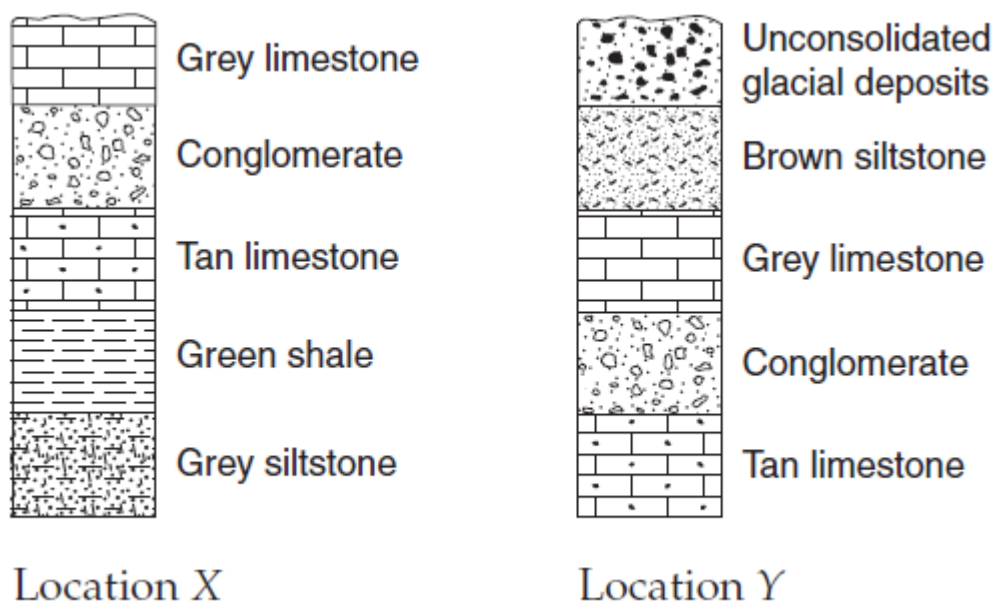
A teacher used this dessert to model the geological history of sediments at a particular place.



- i) How could this dessert be used as a model to explain how geological history is interpreted?
- ii) What geological reason could the teacher use to explain the absence of lollies in the bottom layer of jelly?
- iii) Outline ONE advantage and ONE limitation of using this model to illustrate geological history

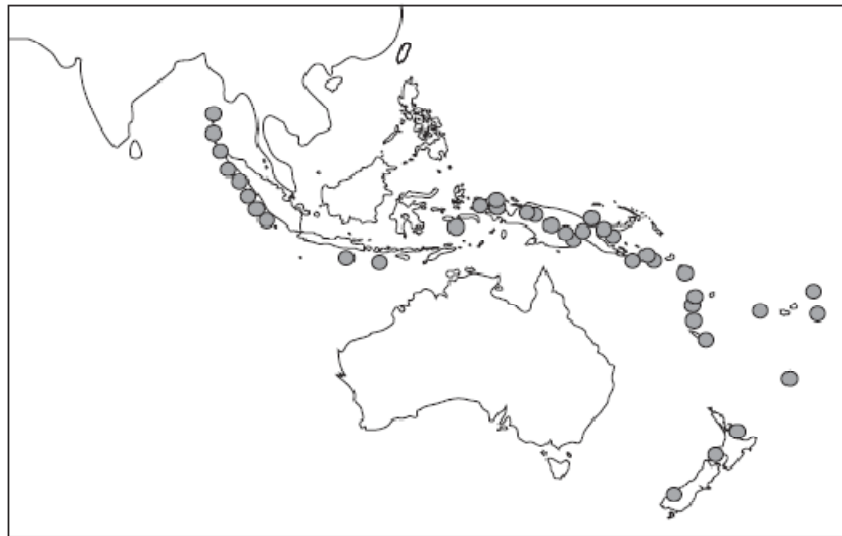
School Certificate 2008

1) Multiple Choice



- i) Which rock layer is the oldest
 - (A) Green shale
 - (B) Grey siltstone
 - (C) Tan limestone
 - (D) Unconsolidated glacial deposits
- ii) What causes sea-floor spreading and continental drift?
 - (A) Varying sea levels
 - (B) Convection currents in the mantle
 - (C) Changes in Earth's magnetic field
 - (D) Contraction of the crust as Earth cools

The shaded areas show the location of recent earthquakes in our region.



iii) What is the best explanation of the location of these earthquakes?

- (A) Earthquakes occur in shallow oceans.
- (B) Earthquakes occur in an east/west line.
- (C) Earthquakes occur close to plate boundaries.
- (D) Earthquakes only occur close to coastal areas

(Refer to Stimulus booklet to answer these questions)

iv) What is the main role of satellites used in the Australian Tsunami Warning System?

- (A) To detect changes in weather conditions
- (B) To detect changes in water pressure on the ocean floor
- (C) To receive and transmit information about changes in the size of water waves
- (D) To receive and transmit radio waves about seismic movements on the ocean floor.

v) Seismic and water waves are shown in the Tsunami Warnings diagram. What is each type of wave carrying?

	<i>Seismic Wave</i>	<i>Water Wave</i>
(A)	Energy	Water
(B)	Magma	Energy
(C)	Shocks	Water
(D)	Energy	Energy

v) Which component of Earth is the Australian Tsunami Warning System (ATWS) designed to protect?

- (A) Atmosphere
- (B) Biosphere
- (C) Hydrosphere
- (D) Lithosphere

vi) What is the geological structure labelled X in the Tsunami Warnings diagram?

- (A) A fault
- (B) A fold
- (C) A mid ocean ridge
- (D) A volcano

(Refer to Stimulus Booklet to answer these questions)

vii) Which group of trilobite became extinct before the beginning of the Ordovician period?

- (A) Lichida
- (B) Proetida
- (C) Odontopleurida
- (D) Redlichiida

viii) Approximately how long did Odontopleurida survive on Earth?

- (A) 145 million years
- (B) 260 million years
- (C) 360 million years
- (D) 505 million years

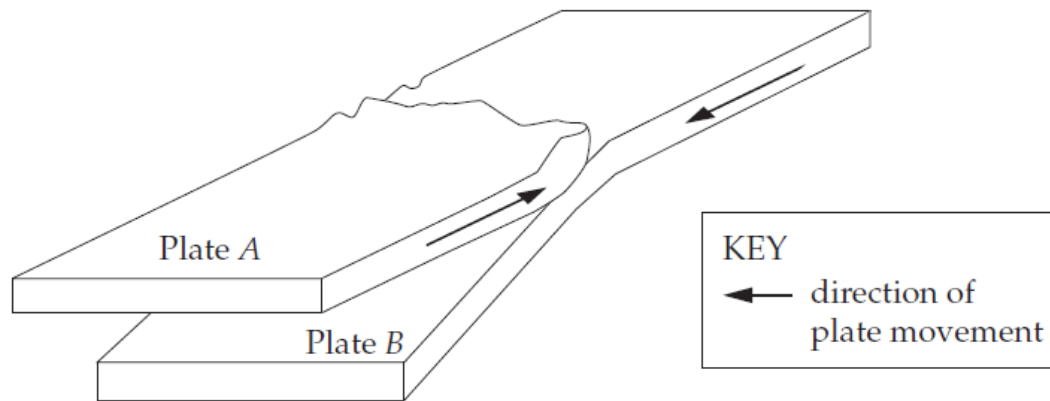
2) Short Answer Questions

(Refer to Stimulus booklet to answer the following questions)

- i) Not all trilobites are used as index fossils.
State why Proetida is not used as an index fossil.
- ii) Identify TWO environmental conditions which led to trilobites being preserved as fossils.
- iii) How can the study of fossils such as Redlichiida trilobites contribute to our understanding of evolution?
- iv) Propose a reason why Proetida survived for so long. Justify your answer

1) Multiple Choice

The diagram shows a model of the interaction at the boundary between two crustal plates.



- i) Which features would you expect to find at this plate boundary?
- (A) Volcanoes and earthquakes on Plate *B*
 - (B) Earthquakes and volcanic mountains on Plate *A*
 - (C) Many deep earthquakes and new ocean floor on Plate *B*
 - (D) Many shallow earthquakes and new ocean floor in Plate *A*

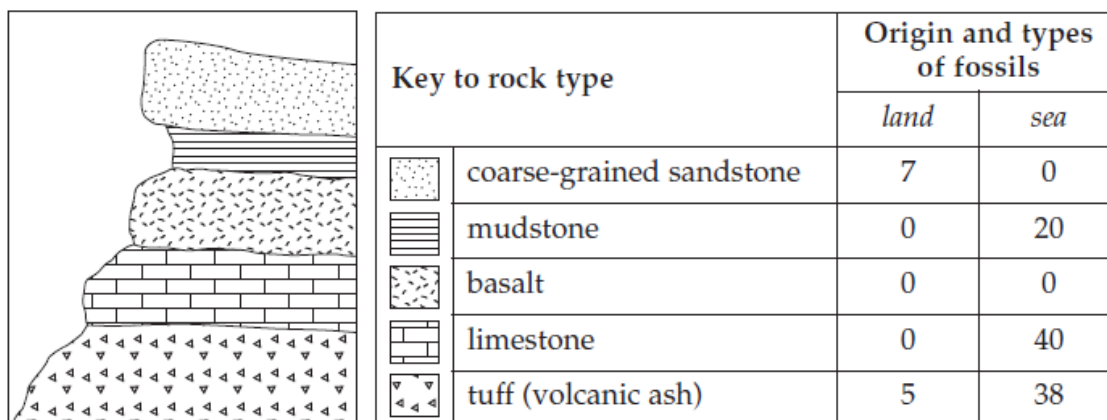
2) One Word Answers

(Refer to Stimulus booklet to answer the following questions)

- i) Along drill path *R*, which type of rock is the oldest?
- ii) Along drill path *Q*, what rock type is found 20 metres below the surface?

1) Multiple Choice

In researching the geology of an area, two scientists made the observations shown in the diagram and table.



- i) The area contains the igneous rock basalt.

Why were no fossils found in this layer?

- (A) Not all organisms form fossils.
- (B) Fossils were too small to be found.
- (C) Fossils do not form in igneous rocks.
- (D) There was not enough time for fossils to form.

- ii) In what environment was the tuff formed?

- (A) An inland lake
- (B) An inland river
- (C) An ocean near a beach
- (D) The middle of an ocean

- iii) Which of the following statements is NOT supported by the information in the diagram and table?

- (A) The number of fossil types has increased over time.
- (B) The number of fossil types has decreased over time.
- (C) Part of this area was formed near volcanoes.
- (D) Part of this area originally formed in the ocean.





iv) Fossil evidence provides a lot of information about Earth. Which of the following supports the idea that Earth is very old?

- (A) Fossils are used in the exploration for oil and gas.
- (B) Fossils show relationships between different groups of organisms.
- (C) Fossils indicate different environments from those that exist today.
- (D) Fossils show a change from simple to more complex forms in different groups of organisms.

v) What natural event is most likely to trigger the formation of a tsunami?

- (A) Cyclone
- (B) Earthquake
- (C) Landslide
- (D) Volcanic eruption

vi) Which pair of arrows represents the direction of plate movement that may result in a tsunami?

- (A) 
- (B) 
- (C) 
- (D) 

2) One Word Answers

(Refer to Stimulus booklet to answer these questions)

- i) Movement of tectonic plates is caused by currents in the mantle. What name is given to this type of current?
- ii) What do tsunami waves carry which is common to all waves?

3) Short Answer Questions

(Refer to Stimulus Booklet to answer question)

- i) Countries such as Japan, are situated in an area known as the Pacific Rim, where earthquakes often occur. Japan and other countries in similar locations, are equipped with technologies to provide early warning of earthquake activity

Justify ONE argument for, and ONE against, installing such early-warning technologies in other areas, such as the Indian Ocean region

- ii) A cyclone is another type of natural event

In the box below, draw up a table containing information that compares impacts of cyclones and tsunami on the environment

School Certificate 2005

1) Multiple Choice

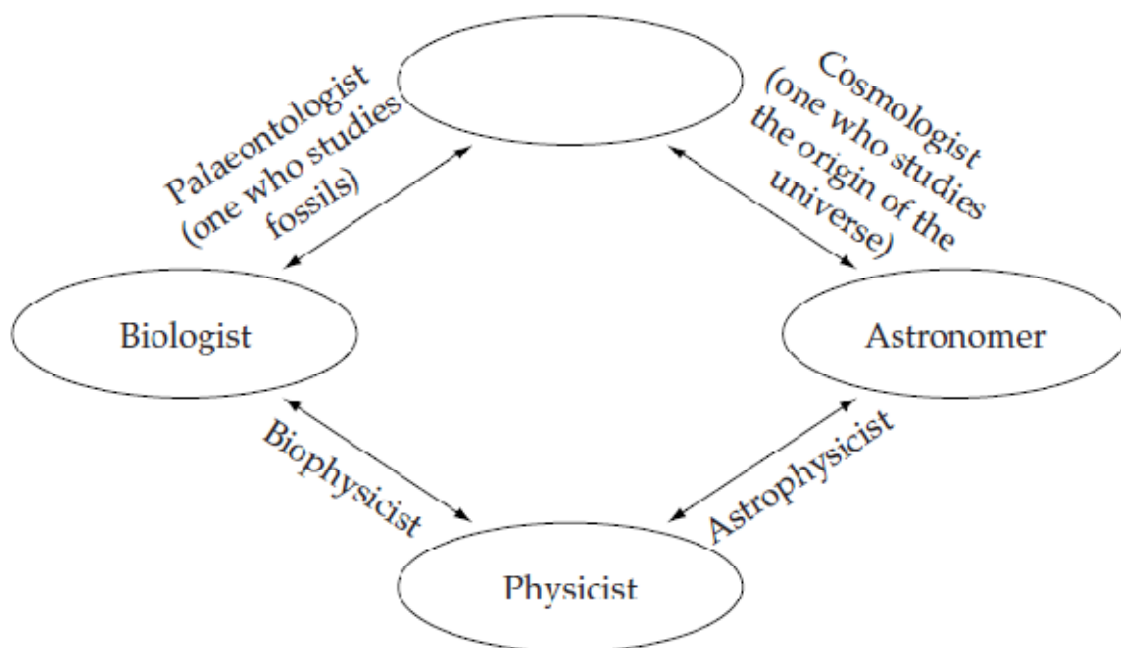
Use the article below to answer questions i) to iii)

Approximately 2300 years ago, some ancient Greek philosophers said earthquakes were caused by underground winds. Others said they were caused by fires deep inside Earth. About 1900 years ago, a Chinese scholar named Chang Heng said that earthquakes are waves that ripple away from the source of the quake. He built a device to detect earthquakes.

In 1859, an Irishman named Robert Mallet said that parts of Earth's crust can be under strain and earthquakes occur when rock breaks or moves to release this strain. In the 1870s, an Englishman named John Milne built a machine called a seismograph to detect earthquakes. In the early 1900s, a Russian named Prince Boris Galitzyn constructed a seismograph to measure earthquake waves.

- i) Who did NOT make equipment to collect information about earthquakes?
- (A) Chang Heng
(B) John Milne
(C) Prince Boris Galitzyn
(D) Robert Mallet

- ii) What does this article indicate about the history of science?
- (A) History and science are not related to each other.
- (B) Different cultures have contributed to science throughout history.
- (C) Our understanding of the world does not change but technology improves.
- (D) People from the past had wrong ideas but modern scientists have right ideas.
- iii) What is the most suitable heading for this article?
- (A) What is an earthquake?
- (B) The history of earthquakes
- (C) How to measure earthquakes using seismographs
- (D) Developing ideas about earthquakes and their detection
- iv)

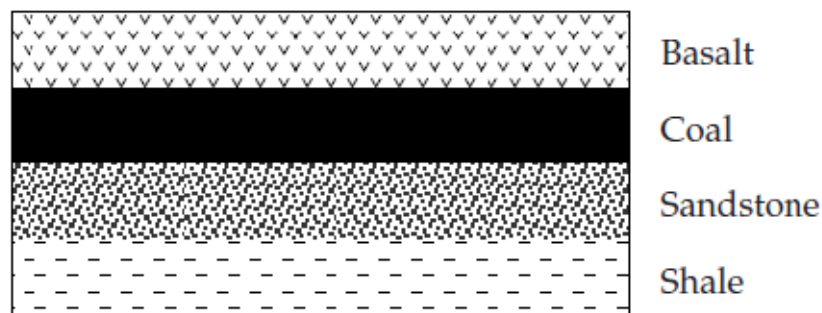


What is the science career that fits into the empty space in the diagram?

- (A) Astrologer
- (B) Chemist
- (C) Geologist
- (D) Surgeon

v)

The diagram shows horizontal rock layers exposed at a cliff face.

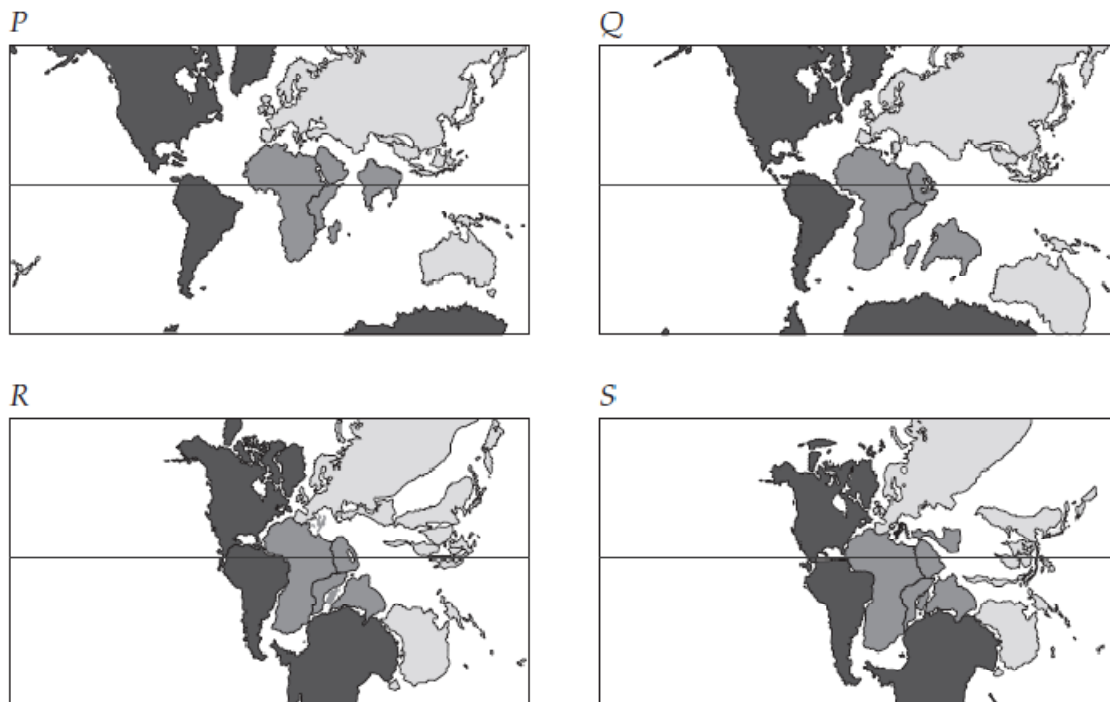


What is the youngest rock exposed at the cliff face?

- (A) Basalt
- (B) Coal
- (C) Sandstone
- (D) Shale

Use the diagram below to follow the next two questions

The diagrams show maps of ancient Earth between 220 million years ago and 50 million years ago.

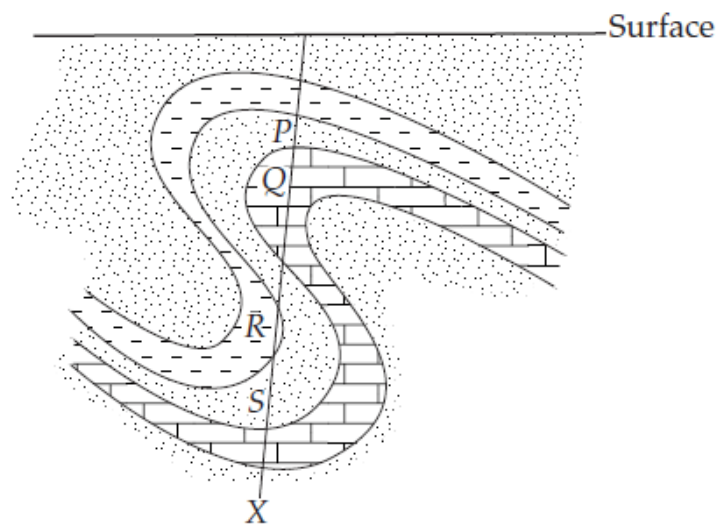


B F Windley, 1995, *The Evolving Continents*, 3rd edn. (C) John Wiley & Sons Limited, West Sussex. Reproduced with permission.

- vi) What is the sequence of these maps to show the changing positions of continents from 220 million years ago to 50 million years ago?
- (A) S RQP
(B) S QRP
(C) P RQS
(D) P QRS
- vii) The process represented by the maps is called continental drift. One theory states that this is caused by the movement of crustal plates over time.

Which of the following provides the best evidence to support this theory?

- (A) Global warming
(B) Coal in Antarctica
(C) Extinction of dinosaurs
(D) Destruction of the ozone layer
- viii) The diagram shows some heavily folded sedimentary rock layers. A hole was drilled from the surface down to point X. Fossil samples were taken from the rocks at P, Q, R and S.



In which rock location would the oldest fossil have been found?

- (A) P
(B) Q
(C) R
(D) S

Use the following article to answer the i) and ii) below

Fossils of ancient psilophytes are found in rocks in northern Queensland.

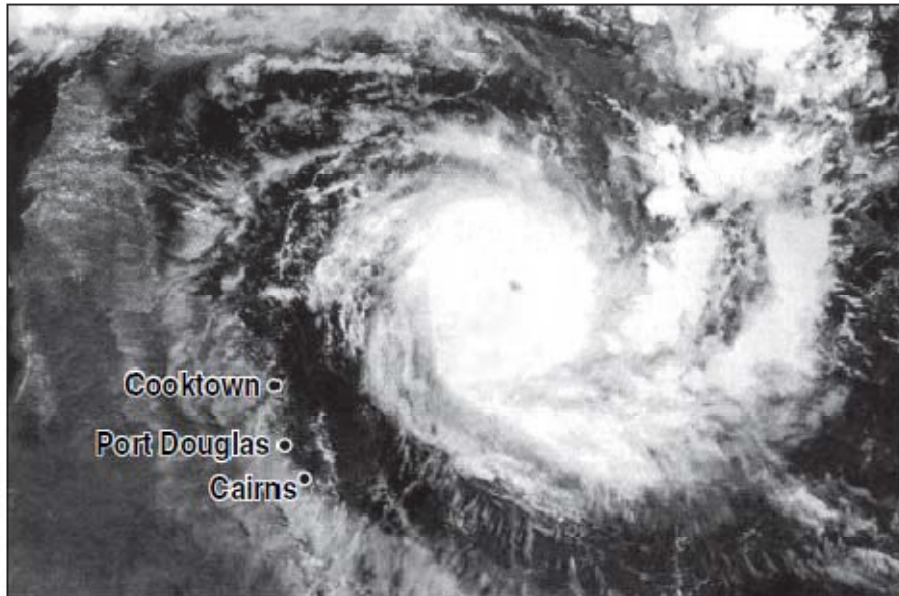
Psilophytes are multicellular organisms that first existed on Earth about 400 million years ago. At that time there was less sunlight on Earth than today.

- ix) What is likely to have happened in this area about 400 million years ago to form these fossils?
- (A) Heat and pressure turned psilophytes into rock.
 - (B) Volcanic eruptions sealed psilophytes inside molten rock.
 - (C) Mud covered psilophytes and prevented them from rotting.
 - (D) Psilophytes were covered by water, due to climatic changes.
- x) What is the best explanation for there being less sunlight on Earth 400 million years ago?
- (A) Earth was much further away from the Sun.
 - (B) There was more dust in Earth's atmosphere.
 - (C) The Sun was younger, smaller and gave out less energy.
 - (D) Earth had less gravity, so less light was drawn towards Earth.

2) One word Answers

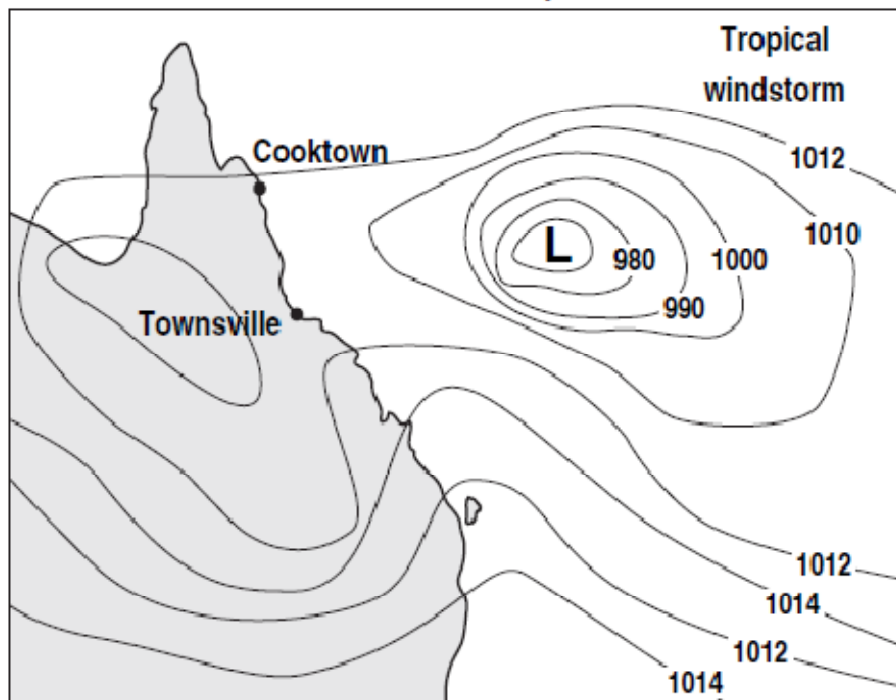
- i) What word describes ALL the parts of Earth, including oceans and the atmosphere, that contain living things?
- ii) A violent tropical windstorm on or near the Australian coast is shown below. What name is given to this type of storm?

Satellite photograph



Reproduced with the permission of the Sydney Morning Herald.

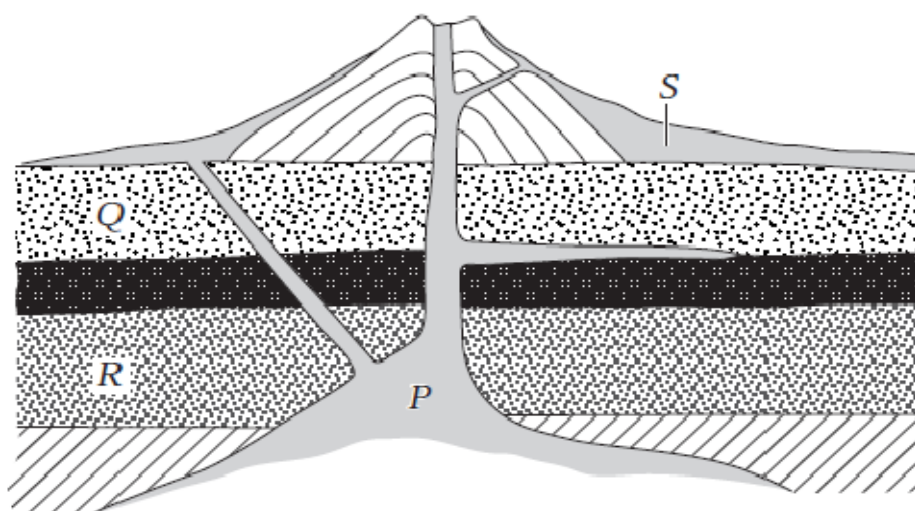
Weather map



1) Multiple Choice

- i) Which of the following environments is best for fossil formation?
- (A) Lava flow
 - (B) Exposed beach
 - (C) Base of cliff
 - (D) Muddy river mouth
- ii) Which statement best describes the current scientific explanation for the cause of earthquakes?
- (A) Earth's crust is made of large plates that move against each other.
 - (B) Chemical reactions inside Earth make gases that push up Earth's surface.
 - (C) The Moon, Sun and planets cause gravitational forces that pull Earth's surface.
 - (D) Rocks in the lithosphere tend to sink, while rocks in the asthenosphere tend to rise.
- iii)

The diagram shows a geological cross-section of an area.



Which of the labelled rocks is the oldest?

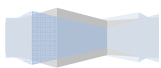
- (A) P
- (B) Q
- (C) R
- (D) S

2) *One word Answers*

- i) What is the scientific term that describes the currents that cause the movement of the crustal plates?

Glossary

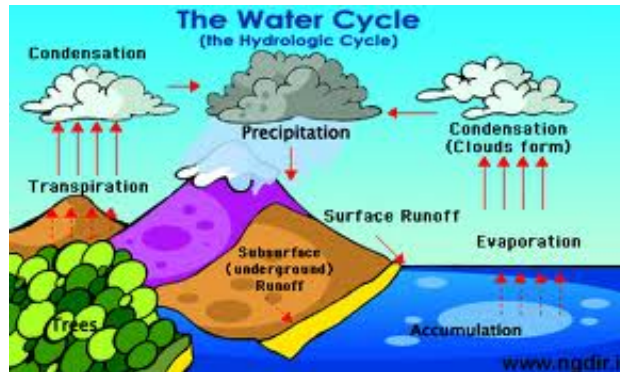
fossil, law of superposition, correlation, geological time scale, plate tectonics, convection currents, epicentre, Mercalli Scale, Richter Scale, atmosphere, hydrosphere, lithosphere, biosphere



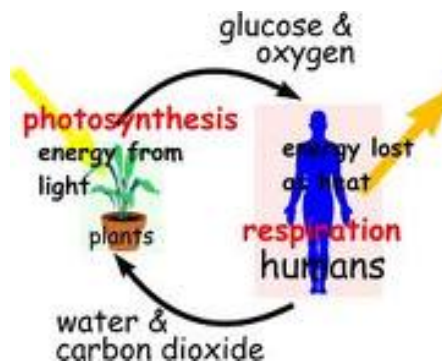
Ecosystems

Cycles

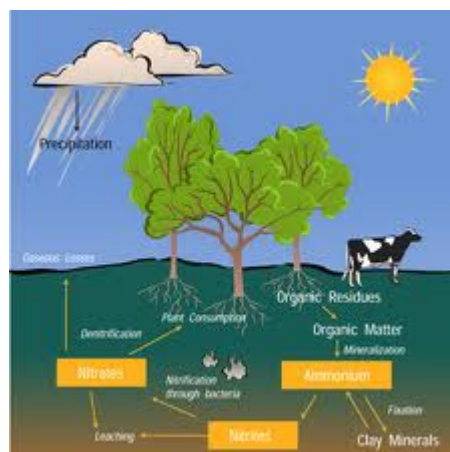
- ☺ Water cycle – ensures continual supplies of fresh water for plants and animals.



- ☺ Carbon-oxygen cycle – ensures continual supplies of carbon dioxide for photosynthesis by plants and oxygen for respiration by plants and animals.



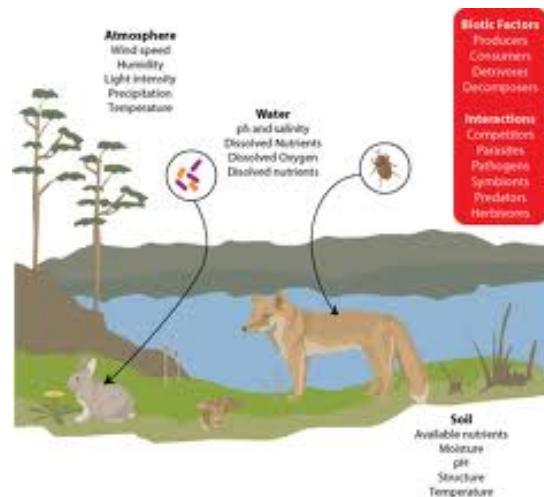
- ☺ Nitrogen cycle – ensures continual supplies of nitrogen in the form of nitrates in the soil for use by plants and then animals as they eat plants.



Abiotic And Biotic Factors

An organism is affected by abiotic and biotic factors in its environment.

- ☺ abiotic – physical factors eg. temperature, water availability, wind speed, soil type, soil pH, humidity
- ☺ biotic – biological factors eg. predators, prey, competitors, disease-causing organisms



Environment, Habitat And Biodiversity

- ☺ environment – all the things that surround and affect an organism in its life
- ☺ habitat – the place in an environment where a plant or animal lives
- ☺ biodiversity – the variety of organisms in an environment

Introduced Species

The introduction of animals and plants into Australia since European settlement has had devastating impacts on ecosystems. The rabbit was introduced into Victoria in the mid 1800s. The small population reproduced very quickly and spread rapidly into other states. The large numbers of rabbits stripped the land bare of grass and dug burrows over much of the land. As a result, some small native mammals, such as the bilby, were forced to compete with the rabbit for food and space and the consequences were disastrous. The lack of food and space caused large numbers of native animals to perish while surviving animals were pushed into harsher environments. The flourishing rabbit population also led to a rise in the fox and feral cat populations, both of which preyed on numerous native animals. All of these factors resulted in a severe decrease in the reproduction of native animals and survival of their offspring, leading to a rapid decline. Ultimately, numerous native species became endangered or extinct.

Revision Questions

1. Why are these cycles in nature important:
 - a) water cycle
 - b) carbon-oxygen cycle
 - c) nitrogen cycle
2. Choose an animal and describe three abiotic factors and three biotic factors in its environment
3. What are “introduced species”?
4. Explain how introduced species can impact on native species

School Certificate 2010

1) Multiple Choice

Use the information below to answer the next two questions

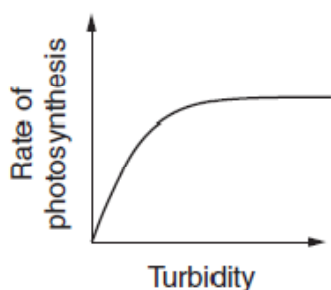
Turbidity is a measure of the cloudiness of a body of water. As turbidity increases, the amount of sunlight that is able to penetrate the water decreases. Plants living below the water surface need sunlight for photosynthesis.

- i) What type of feature is turbidity?
- (A) Abiotic
 - (B) Biological
 - (C) Biotic
 - (D) Natural

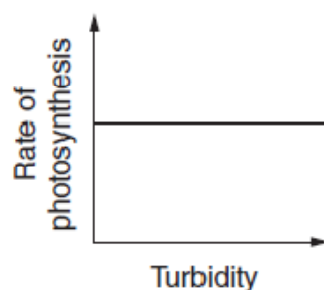
ii)

Which graph best shows the relationship between turbidity and the rate of photosynthesis in plants living below the water surface?

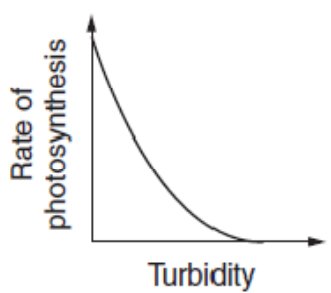
(A)



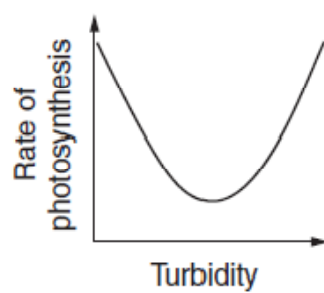
(B)



(C)



(D)



School Certificate 2009

1) **Multiple Choice**

i) Which process involves plants using carbon dioxide?

- (A) Burning
- (B) Decay
- (C) Photosynthesis
- (D) Respiration

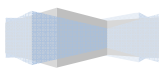
ii) Which processes add carbon dioxide to the atmosphere?

- (A) Burning, decay and respiration
- (B) Burning, decay and photosynthesis
- (C) Respiration, decay and photosynthesis
- (D) Burning, photosynthesis and respiration

iii) Organisms involved in decay are called decomposers.

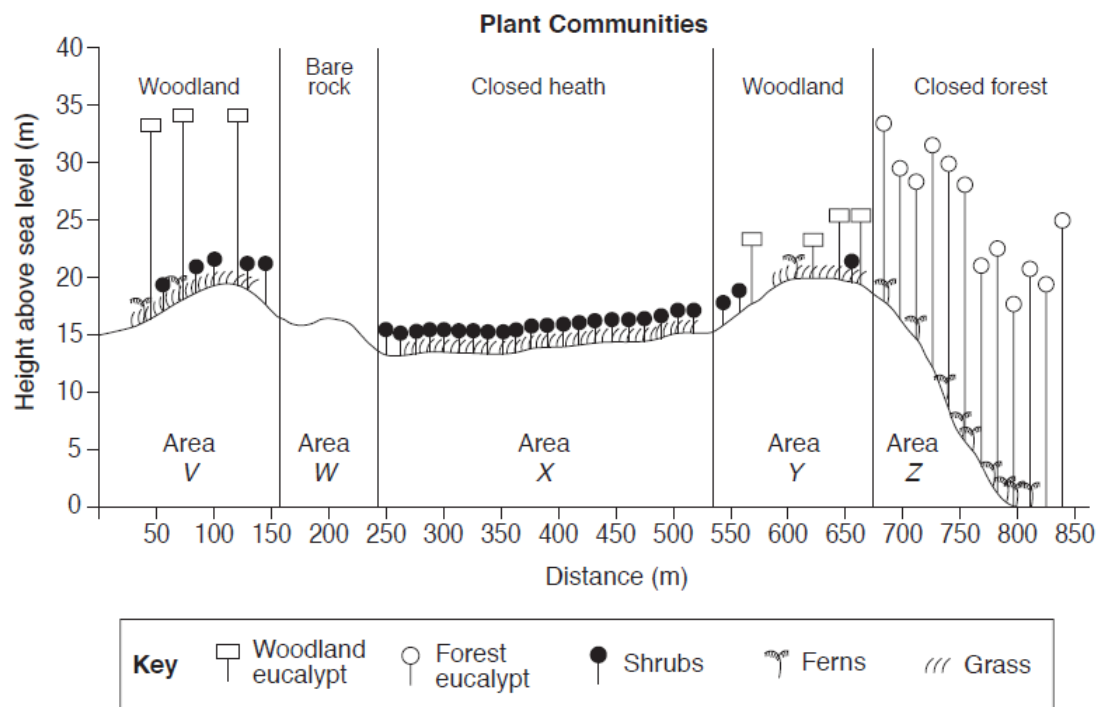
What role do decomposers play in the carbon cycle?

- (A) They provide food for animals.
- (B) They allow carbon to be reused.
- (C) They limit the number of plants in an ecosystem.
- (D) They remove carbon dioxide from the atmosphere.



iv)

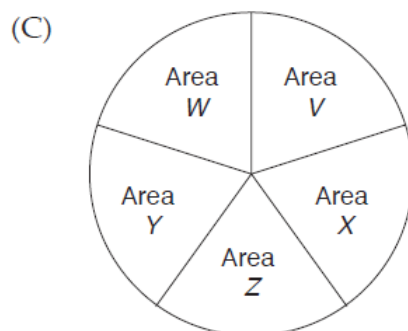
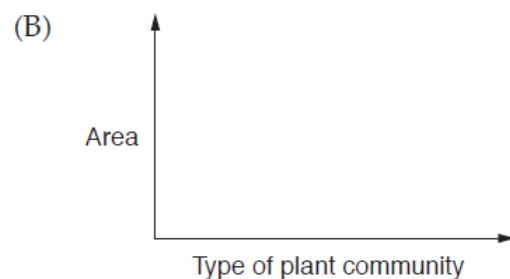
The diagram shows the distribution of plant communities in an ecosystem.



15 What is the best way to record the numbers and types of plants found in each area?

(A)

	Type of plant community
Area	



(D)

Area	Number of plants				
V					
W					
X					
Y					
Z					

- v) What is the height of the tallest eucalypt?
- (A) 18 m
 - (B) 26 m
 - (C) 34 m
 - (D) 840 m
- vi) Which area of the ecosystem shows ONLY abiotic features?
- (A) W
 - (B) X
 - (C) Y
 - (D) Z

School Certificate 2008

1) Multiple Choice

- i) Which group contains only biotic features of the environment?
- (A) Rocks, soil, air
 - (B) Fungi, soil, rocks
 - (C) Plants, bacteria, air
 - (D) Plants, fungi, bacteria
- ii) Which is the best explanation of the greenhouse effect?
- (A) A decrease in carbon dioxide in the atmosphere traps more heat and allows more ultraviolet radiation to reach Earth's surface.
 - (B) An increase in the ozone layer decreases the amount of ultraviolet radiation that reaches Earth's surface.
 - (C) A decrease in the ozone layer allows more radiation to reach Earth's surface.
 - (D) An increase in carbon dioxide in the atmosphere traps more heat radiation from Earth.
- (Refer to stimulus booklet to answer this question)
- ii) Why is mercury from dumped Compact Fluorescent Light (CFL) bulbs considered a pollutant in ecosystems?
- (A) It is part of the air.
 - (B) It has a metallic taste.
 - (C) It can be harmful to organisms.
 - (D) It is undetectable in the environment.

2) Short Answer Questions

(Refer to Stimulus booklet to answer the following questions)

- i) Name an environmental advantage of using CFL bulbs and explain why it is a benefit.

School Certificate 2007

1) Multiple Choice

- i) The word equation for photosynthesis is:

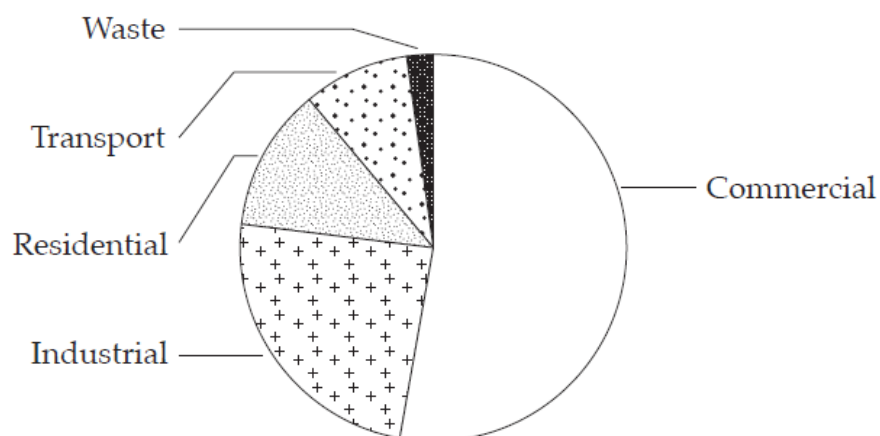
carbon dioxide + water \rightarrow glucose + oxygen + water

What are the reactants for photosynthesis?

- (A) Oxygen and glucose
- (B) Carbon dioxide and water
- (C) Light, oxygen and glucose
- (D) Light, carbon dioxide and water

ii)

The sector graph shows the five main sources of greenhouse gases emitted by the city of Sydney in 2004.



What approximate percentage did industrial activities contribute?

- (A) 26
- (B) 33
- (C) 53
- (D) 69

iii) Which of the following would be classified as an abiotic factor in the ecosystem?

- (A) Sun
- (B) Producers
- (C) Consumers
- (D) Decomposers

(Refer to Stimulus Booklet to answer the next three questions)

iv) Which greenhouse gas is least affected by human activities?

- (A) Methane
- (B) Water vapour
- (C) Nitrous oxide
- (D) Carbon dioxide

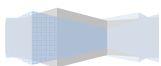
v) What is the purpose of carbon dioxide capture and storage (CCS)?

- (A) To stop carbon dioxide emissions going into the atmosphere
- (B) To enable a more efficient coal-burning process to occur
- (C) To slow the increase in atmospheric temperature
- (D) To capture carbon dioxide for re-use

vi) Methane is a gas that increases the greenhouse effect.

What type of human activity would need to be modified to reduce methane production?

- (A) The use of cars
- (B) The burning of coal
- (C) Pollution from factories
- (D) Farming practice



2) One Word Answers

i)

The word equations below show two important processes which are part of the global carbon cycle.

<i>Process</i>	<i>Word Equation</i>
Photosynthesis	carbon dioxide + water \rightarrow glucose + oxygen + water
Respiration	glucose + oxygen \rightarrow carbon dioxide + water

Which process will tend to reduce the amount of carbon dioxide in the atmosphere?

(Refer to the Stimulus Booklet to answer the next four questions)

- ii) What was the atmospheric carbon dioxide level in 1995?
- iii) What was the increase in the concentration of atmospheric carbon dioxide between 1980 and 2000?
- iv) What is the average increase in surface temperature (in°C) caused by the presence of Earth's atmosphere?
- v) Rocks are one place where scientists think carbon dioxide may be stored. Name the other place where carbon dioxide can be stored.

3) Short Answer Questions

- i) Draw a labelled diagram to show the life cycle of the cane toad.
- ii) Predict ONE way in which the ecosystem would change if scientists found a way to remove cane toads. Give a reason for your prediction.
- iii) Outline a strategy to balance the need to conserve and protect the environment at Mount Morgan with the need to mine minerals.

Provide a reason for and a reason against the use of this strategy.

1) *Multiple Choice*

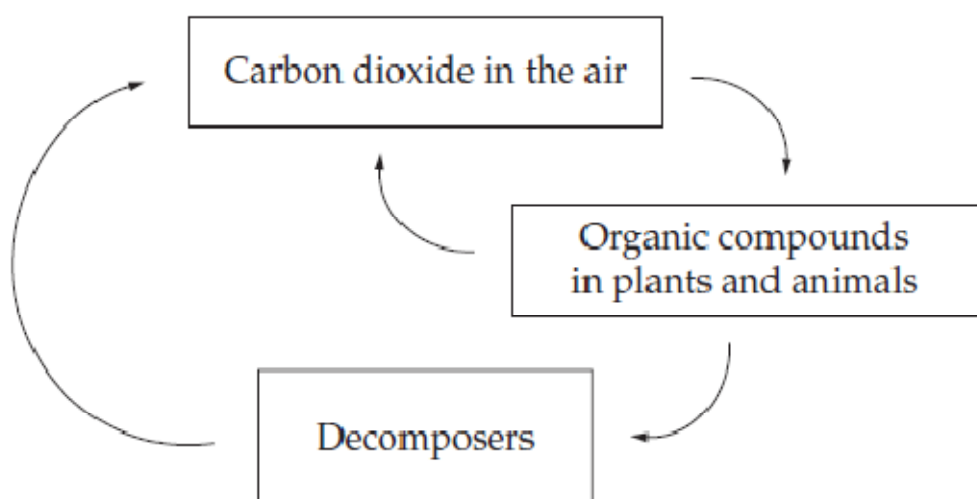
- i) LEDs (light-emitting diodes) convert electrical energy directly into light. LEDs do not have 'bulbs' like light globes, but use a lens to focus the light. LEDs are efficient, give off little heat, and can be made of plastic.

What is one benefit to the environment of using LEDs?

- (A) Plastics are stronger than glass.
(B) LEDs have a greater range of colours.
(C) LEDs are made from renewable resources.
(D) Less heat will be released into the surroundings.

ii)

The diagram shows a process that occurs in an ecosystem.



What process is this diagram showing?

- (A) Cycling of material
(B) Decomposition
(C) Energy flow
(D) Pollution

iii) Which of these is a biotic factor of the Southern Ocean ecosystem?

- (A) Blue Whale
- (B) Plastic waste
- (C) Shipping noise
- (D) Water temperature

2) Short Answer Questions

- i) Select a human activity that impacts on whale habitats, and explain how this activity could affect whales.
- ii) Some groups in our society support a ban on whaling. Their reasons may be legal, economic or scientific.

Justify, with a scientific argument, why some groups in society would support a ban on whaling.

School Certificate 2005

1) Multiple Choice

- i) Some scientists believe that releasing too much carbon dioxide into the atmosphere changes the weather on Earth.
What could cause these weather changes?
 - (A) Carbon dioxide traps energy in the atmosphere.
 - (B) Solid carbon dioxide (dry ice) falls as hailstones.
 - (C) Carbon dioxide uses up energy in the atmosphere.
 - (D) Carbon dioxide lets more energy escape from the atmosphere.
- ii) Which of the following are two abiotic factors of some Australian ecosystems?
 - (A) Rabbits and snakes
 - (B) Bushfires and kangaroos
 - (C) Frequent drought and flies
 - (D) High winds and low rainfall

2) One word Answers

What word describes ALL the parts of Earth, including oceans and the atmosphere, that contain living things?

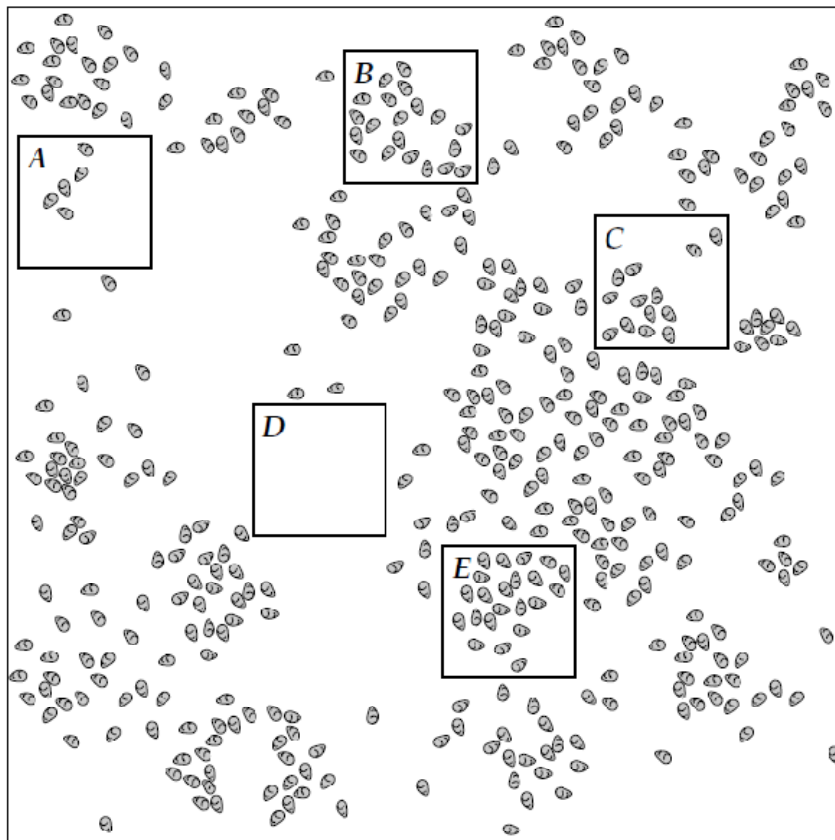
3) Short Answer Questions

- a) The Tasmanian Devil is a small mammal found in scrubland in Tasmania. Scientists have recently become concerned because the number of Tasmanian Devils caught or seen in the wild has changed.

In 1975, the number of Tasmanian Devils seen in a 25 square kilometre area around the city of Hobart was 400. In the same area in 2004, only 100 animals were seen. As a result, scientists have kept their exact location secret and turned the area into a nature reserve.

- i) Suggest ONE reason why scientists have turned the area where **1** Tasmanian Devils were seen into a nature reserve
 - ii) Identify ONE other way that scientists could conserve Tasmanian Devils.
 - iii) Explain how ONE human activity could have reduced Tasmanian Devil **2** numbers
 - iv) Give ONE reason why society should support scientific research about **1** Tasmanian Devil numbers.
- b)

The diagram represents the positions of small, shell-covered animals on a rocky ocean shore. Five equal areas have been randomly marked as boxes A to E on the diagram.



- i) Count the number of shell-covered animals in each box, *A* to *E*. Construct a table in the space below that clearly presents this information
- ii) Calculate the average number of shell-covered animals per box on the diagram. Show all your working.
- iii) What would you do to find out if this average is typical of a rocky ocean shore environment?

School Certificate 2004

1) Multiple Choice

- i) Which of the following is an example of an abiotic feature of an environment?
 - (A) Air
 - (B) Fungus
 - (C) Human
 - (D) Plant
- ii) Which of the following releases large amounts of carbon dioxide into the atmosphere?
 - (A) Evaporation of oceans
 - (B) Combustion of fossil fuels
 - (C) Generation of power by wind turbines
 - (D) Generation of power using nuclear energy

2) One word Answers

What scientific term describes contamination of an environment by unwanted substances?

Glossary

Abiotic, biotic, environment, nitrogen cycle, carbon cycle, water cycle, pollution, habitat





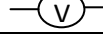


Electricity

An **electric current** is made up of moving electric charges that have electrical energy.

A **conductor** is a substance that electric current flows through eg. metals, carbon. Conductors are used in electrical wiring to carry electric current to electrical appliances.

An **insulator** is a substance that electric current does not flow through eg. non-metals. Insulators are used to enclose electrical wiring and some electrical appliances to protect people from electrocution.

A **resistor** is a substance that electric current can flow through with difficulty and some of its electrical energy is changed into heat and light. They are used in appliances that produce heat and light eg. light globe, toaster, room heater, stove element.

Component	Symbol
Power supply	
Wire	
Lamp	
Ammeter	
Voltmeter	
Switch	
Resistor	

Voltage

Mains power and batteries supply electrical energy to electrical charges so that they can move around an electric circuit. In an electric circuit, the voltage across a power pack or battery measures the amount of electrical energy given to each electric charge.

As electric charges move through resistors they lose some of their electrical energy as it changes into heat and light. In an electric circuit, the voltage across a lamp or other resistor measures that amount of electrical energy that each electric charge loses as heat or light. Voltage (V) is measured on a meter called a voltmeter in units called volts (V).

Current

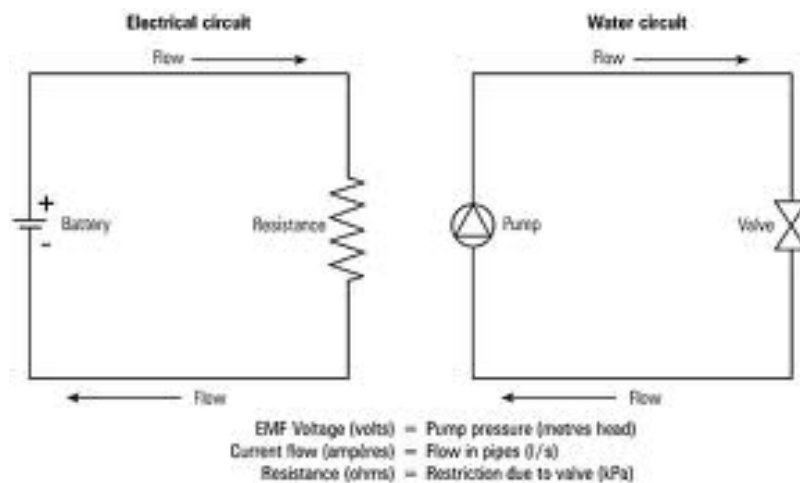
The number of electric charges that move in an electric circuit is called the current. When the current is large, eg 10A, more electric charges move around the electric circuit. When the current is small, eg 0.01A, fewer electric charges move around the electric circuit. Current (I) is measured on a meter called an ammeter in units called amps (A).

Resistance

In an electric circuit, components, such as lamps, have resistance which means that they try to stop the electric charges from moving. If the resistance is high, many of the electric charges have difficulty moving and lose some of their electrical energy as it changes to heat and light. If the resistance is low, the electric charges move easily and lose very little of their electrical energy.

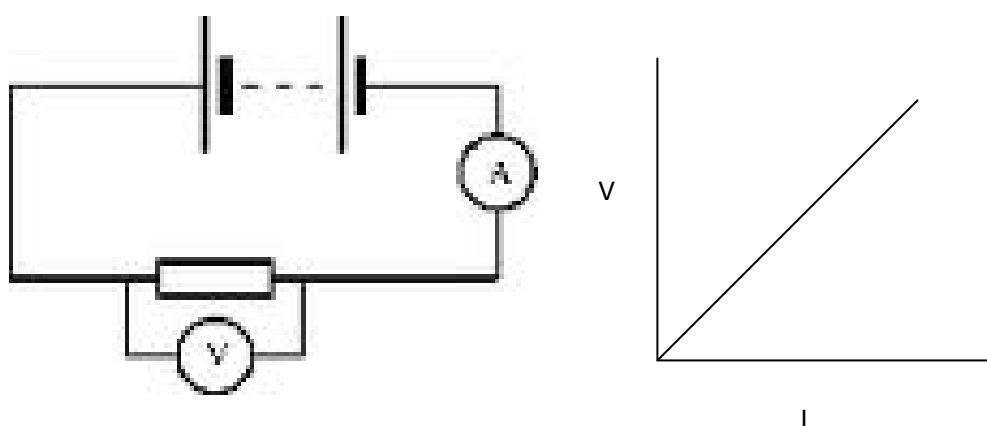
Resistance (R) is measured in units called ohms (Ω).

A Water Analogy For Voltage, Current And Resistance



WATER PIPES	ELECTRIC CIRCUIT
The pump gives kinetic energy to the water so that it moves through the pipes.	The battery gives electrical energy to the electric charges so that they move around the circuit.
The meter measures the amount of water flowing through the pipes.	The ammeter measures the amount of electric charges moving around the circuit.
The filter resists the flow of water. Some of the kinetic energy is changed into other forms of energy. The amount is measured on the gauge.	The light bulb is a resistor that changes some of the electrical energy into heat and light. The amount is measured on a voltmeter.
Water can flow when the tap is turned on.	Electric charges can move when the switch is turned on.

Relationship Between Voltage, Current, Resistance – Ohm's Law



The graph above shows that for an electric current moving through a resistor, as the current increases, the voltage across the resistor increases. This is because as the current increases, more electric charges are taking more electrical energy through the resistor. This means that more electrical energy is being changed into heat and light and so the voltage increases.

Ohm's Law states that the current flowing through a resistor is proportional to the voltage across it.

The equation for Ohm's Law is:

$$\text{VOLTAGE} = \text{CURRENT} \times \text{RESISTANCE}$$



Series And Parallel Circuits

Figure 1 shows two lamps in series and figure 2 shows two lamps in parallel. Lamps are more commonly connected in parallel because they glow brighter, they can be turned on and off independently of one another and if one lamp breaks, the others still work.

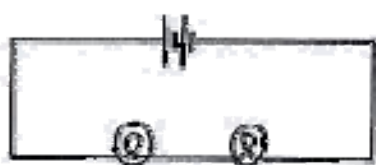


Figure 1

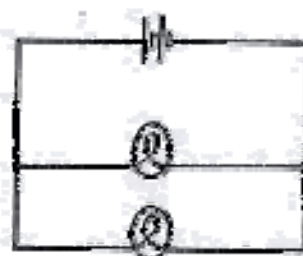


Figure 2

Glossary

Electric current, circuit, voltmeter, ammeter, resistance, voltage, resistor, amps, series, parallel, conductor, insulator

Revision Questions

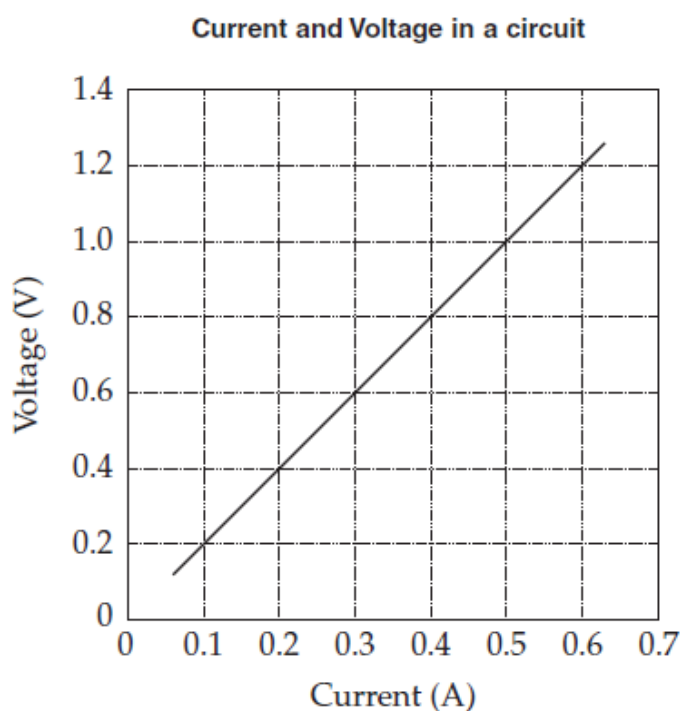
1. What is an electric current?
 2. What is voltage?
 3. What is a voltmeter used for?
 4. What are volts?
 5. What is current?
 6. Which instrument is used to measure current?
 7. In which units is current measured?
 8. Components in an electric circuit have resistance. What does this mean?
 9. What are ohms?
 10. In what way is a water pump like a battery?
 11. In what way is a water meter like an ammeter?
 12. In what way is a water filter like a light bulb?
 13. In what way is a water tap like an electric switch?
 14. Using the equation $V = IR$, calculate the voltage of a hair dryer that draws a current of 5A and has a resistance of 48Ω .
 15. Draw a diagram of an electric circuit showing three light globes connected in series.
 16. Draw a diagram of an electric circuit showing three light globes connected in parallel.
- Explain why light globes in a house are connected in parallel rather than in series

School Certificate 2010

1) Multiple Choice

Use the following graph to answer the following questions

The graph shows the relationship between the current and voltage in a circuit.



i) What was the current when the voltage was 0.4 V?

- (A) 0.1 A
- (B) 0.2 A
- (C) 0.4 A
- (D) 0.8 A

ii)

The resistance of the circuit is given by the following formula.

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

Resistance is measured in units called Ohms.

What is the resistance of the circuit?

- (A) 0.5 Ohms
- (B) 0.6 Ohms
- (C) 1.0 Ohms
- (D) 2.0 Ohms

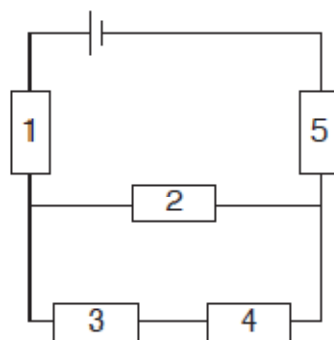
iii) What conclusion can be drawn from the graph?

- (A) The resistance increases as the current increases.
- (B) The resistance decreases as the current increases.
- (C) The voltage increases as the current increases.
- (D) The voltage decreases as the current increases.

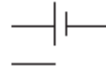
iv)

Use the following diagram to answer the next two questions

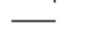
The diagram represents an electrical circuit.



Key



Voltage supply



Wire



Light globe

Which globes in the electrical circuit are connected in parallel?

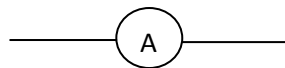
- (A) 1 and 2
- (B) 2 and 4
- (C) 3 and 4
- (D) 1 and 5

v) Which other globe would stop working if globe number 3 burnt out?

- (A) 1
- (B) 2
- (C) 4
- (D) 5

2) One word Answers

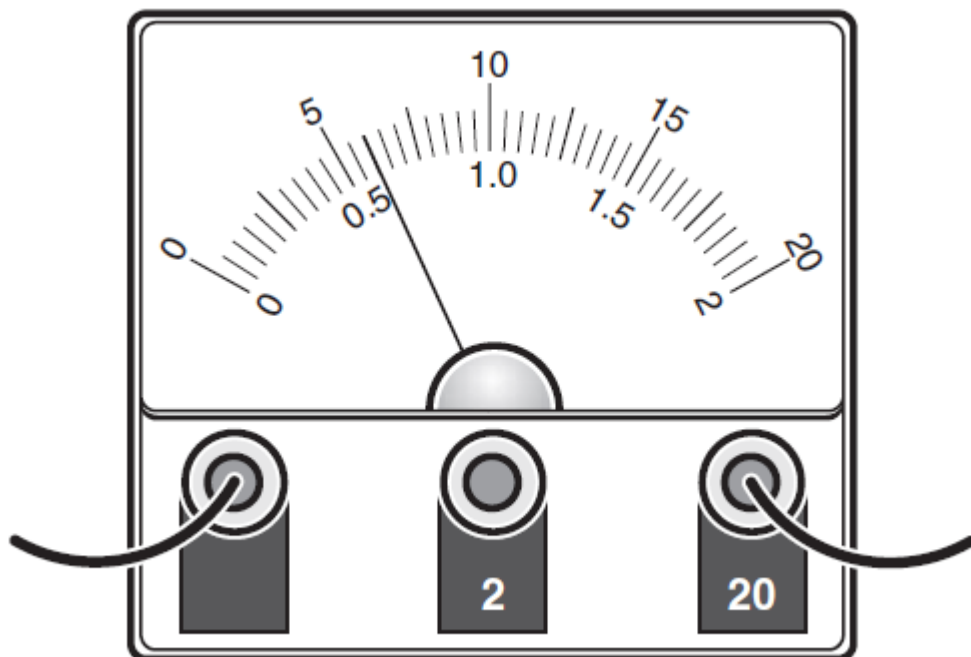
i) What component of an electric circuit is represented by this symbol?



School Certificate 2009

1) Multiple Choice

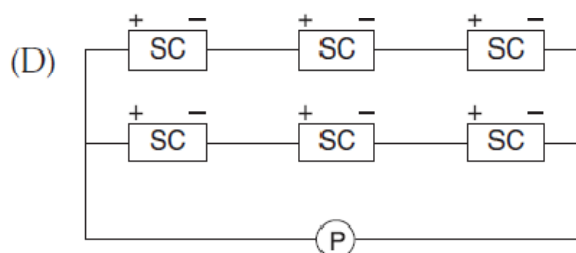
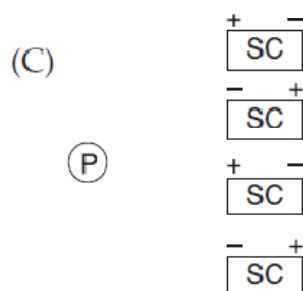
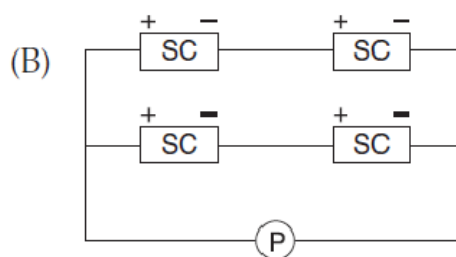
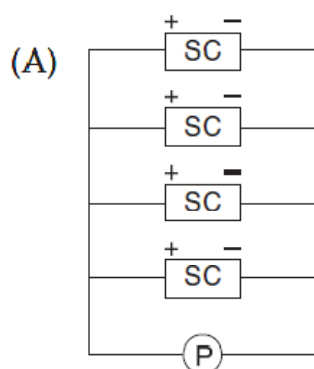
i)



What is the reading on the voltmeter?

- (A) 0.52 V
- (B) 0.6 V
- (C) 5.2 V
- (D) 6.0 V

- ii) The individual pieces of silicon in a SLIVER[®] cell are arranged in a series circuit. Which diagram shows all the SLIVER[®] cells arranged in a series circuit?



Key	<div style="display: inline-block; border: 1px solid black; padding: 2px; text-align: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> +- </div> <div style="text-align: center;">SC</div> </div>	SLIVER [®] cell	— Wire	Ⓟ Mobile telephone
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School Certificate 2008



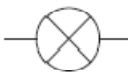
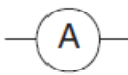
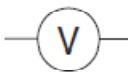
1) *One word Answers*

(Refer to stimulus booklet to answer the question)

What is the saving in electricity costs per year if a CFL bulb is used instead of an incandescent bulb?

2) Short Answer Questions

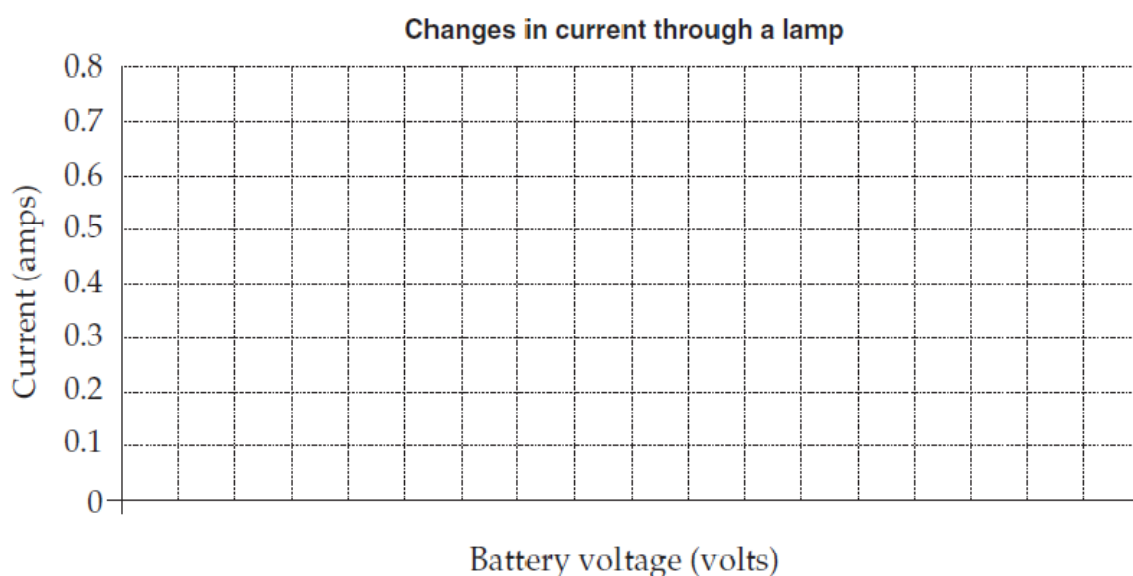
- i) A student investigated the change in current flow through a lamp, using different batteries. An ammeter was connected in series and a voltmeter was connected in parallel to the lamp.

Component	Battery	Wire	Lamp	Ammeter	Voltmeter
Symbol					

- a) Draw a circuit diagram for this experiment using the symbols given.
- b) The results obtained were tabulated. The student did not record results for 6 volts and 16 volts.

Battery (volts)	Current (amps)
2	0.15
4	0.28
8	0.40
10	0.42
14	0.67

- c) Plot the results and rule a line of best fit for them



- d) Use the graph to predict the current for a voltage of 6 volts
- e) Use the graph to predict the current for a voltage of 16 volts
- f) Describe the relationship between voltage and current.

1) Multiple Choice

Use the following information to answer the next two questions.

In a circuit, the relationship between the voltage, current and resistance can be written as:

$$\text{Voltage (V)} = \text{Current (I)} \times \text{Resistance (R)}$$

- i) When a circuit becomes hot the resistance increases.
What will happen as a result?
- (A) Current and voltage will both increase.
(B) Current will decrease if the voltage remains the same.
(C) Voltage and current will remain the same.
(D) Voltage will decrease if the current remains the same.
- ii) If the current in a circuit is 6 amperes and the resistance is 4 ohms, what is the voltage?
- (A) 2 volts
(B) 10 volts
(C) 24 volts
(D) 30 volts
- iii) The characteristics of two different electric light bulbs were measured and are shown in the table.

<i>Measurement</i>	<i>Bulb 1</i>	<i>Bulb 2</i>
Voltage applied to bulb	12.00	12.00
Current through bulb	0.20	0.08
Resistance of bulb	60.00	150.00

If Bulb 1 and Bulb 2 were then connected into a parallel circuit, how would they compare?

- (A) Neither bulb would light up.
(B) Both bulbs would be equally bright.
(C) Bulb 1 would be brighter than Bulb 2.

(D) Bulb 2 would be brighter than Bulb 1.

School Certificate 2006

1) Multiple Choice

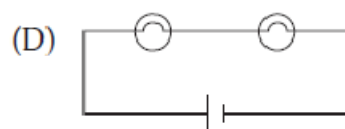
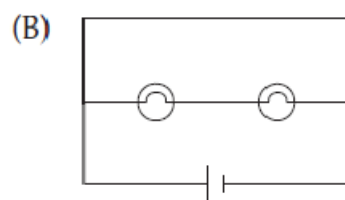
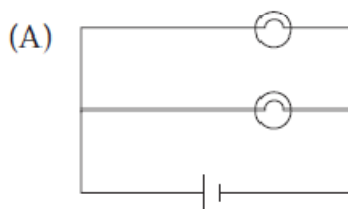
- i) A simple series circuit is set up so the voltage in the circuit remains constant.

What is the relationship between resistance and current in this circuit?

- (A) As the resistance increases, the current increases.
- (B) As the resistance increases, the current decreases.
- (C) As the resistance decreases, the current decreases.
- (D) As the resistance changes, the current stays the same.

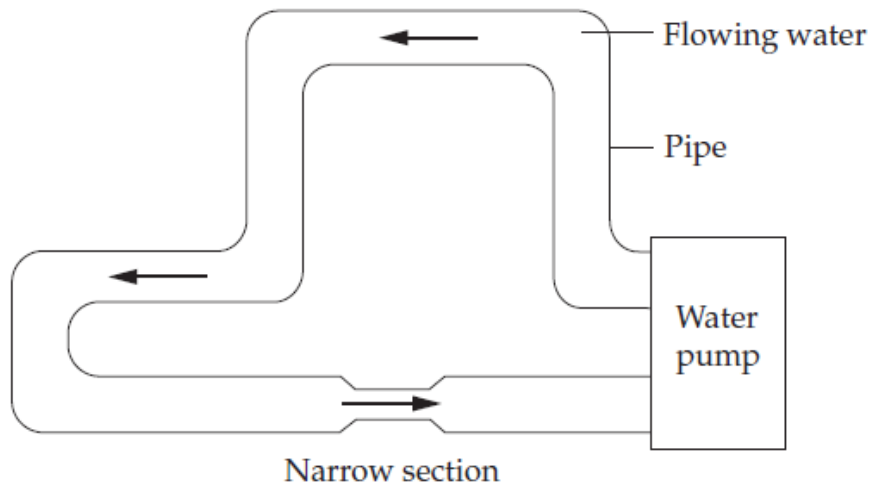
- ii) Margaret wanted to set up a circuit in which two light globes would shine with the same brightness. She also wanted to make sure that one light globe would keep shining even if the other globe was not working.

Which diagram represents a circuit that Margaret could set up to achieve her purpose?



iii)

The diagram represents a water circuit. This diagram can be compared to an electrical circuit.

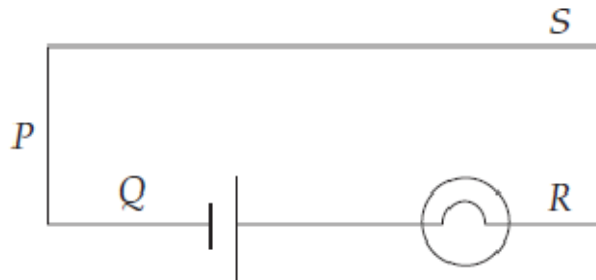


What parts of an electrical circuit match the parts in the water circuit?

	<i>Narrow section</i>	<i>Flowing water</i>	<i>Water pump</i>
(A)	resistor	wire	power source
(B)	resistor	current	power source
(C)	switch	wire	resistor
(D)	switch	current	wire

1) Multiple Choice

- i) The diagram shows an electrical circuit.



Which of the following statements about the current in the circuit is correct?

- (A) It is zero at S.
- (B) It is equal at Q and S.
- (C) It is less at R than at S.
- (D) It is greater at Q than at P.

2) One Word Answers

- i) The diagram shows an ammeter that is connected in a circuit. **2 310 A**

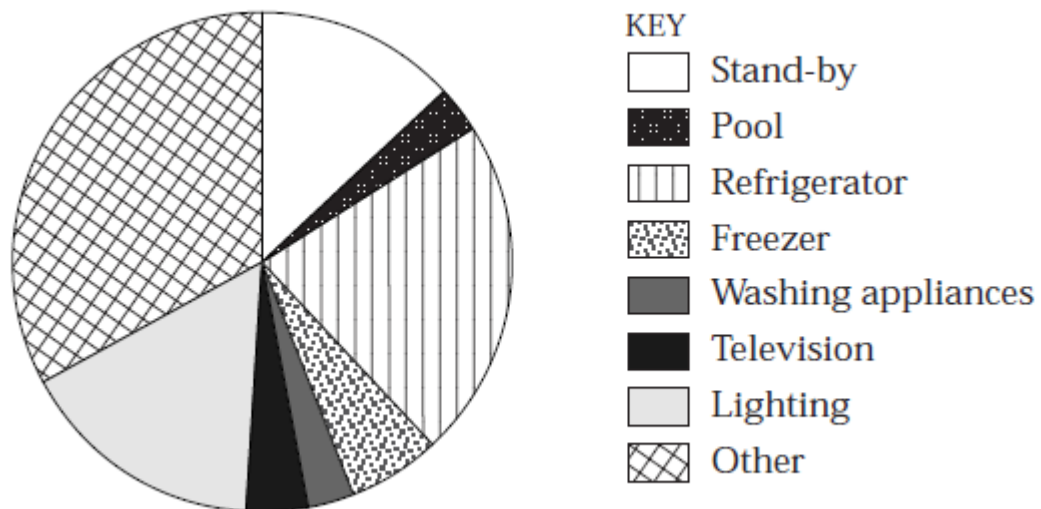


What is the reading on the ammeter in amps?

- ii) In a circuit, light globes are arranged so that if one of the globes goes out, the rest keep glowing. What name is given to this type of circuit?

1) Multiple Choice

- i) Use the graph to answer the next two Questions
The graph shows data about the use of electricity in Australian homes.

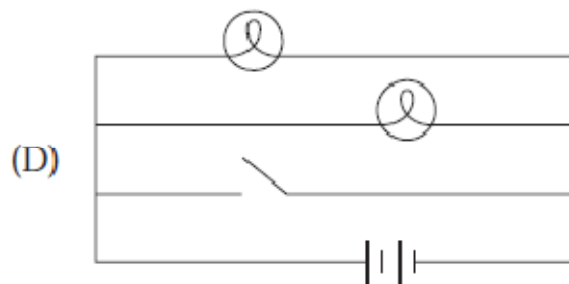
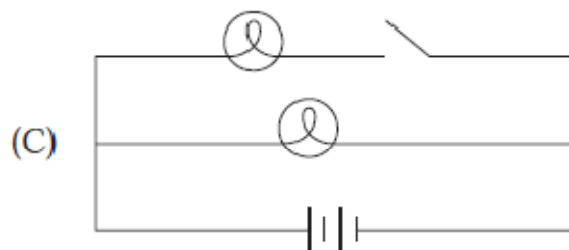
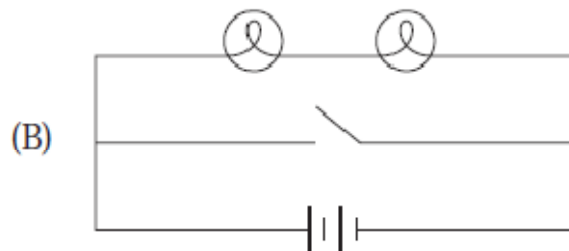
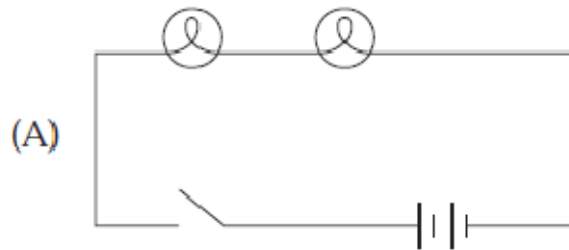


Which of the following uses the most electricity in Australian homes?

- (A) Freezer
(B) Lighting
(C) Stand-by
(D) Television
- ii) Approximately what percentage of electricity in Australian homes is used by refrigerators and freezers?
- (A) 10%
(B) 25%
(C) 60%
(D) 90%

- iii) Delta set up a circuit that consisted of:
- a power source
 - two globes connected in parallel
 - a switch connected in series with one light globe.

Which of the following circuit diagrams represents her circuit?



- iv) How will the current in an electric circuit be affected if the resistance remains constant but the voltage is increased?

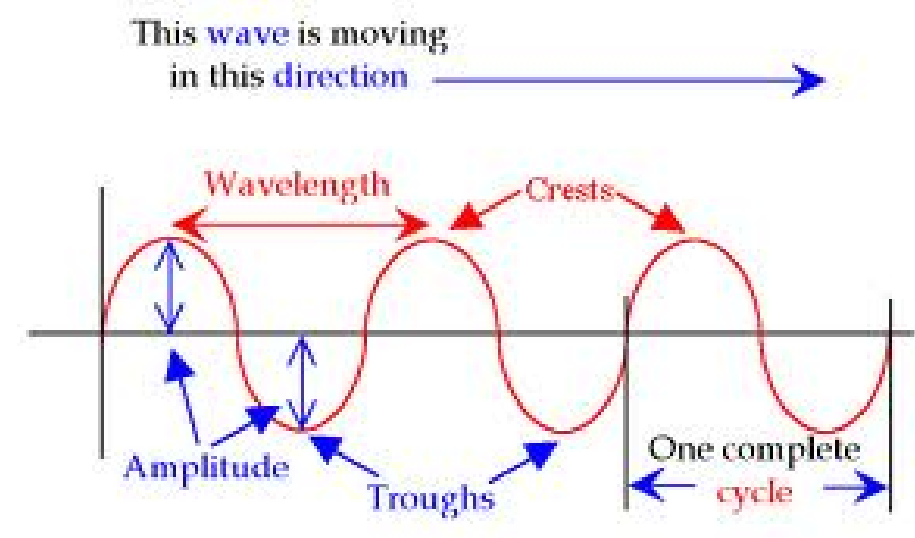
- (A) The current will increase.
(B) The current will decrease.
(C) The current will change direction.
(D) The current will remain unchanged.

Electromagnetic Spectrum, Light and the Universe

Features Of Waves

Waves carry ENERGY.

Waves are often represented by a sine curve as shown below.

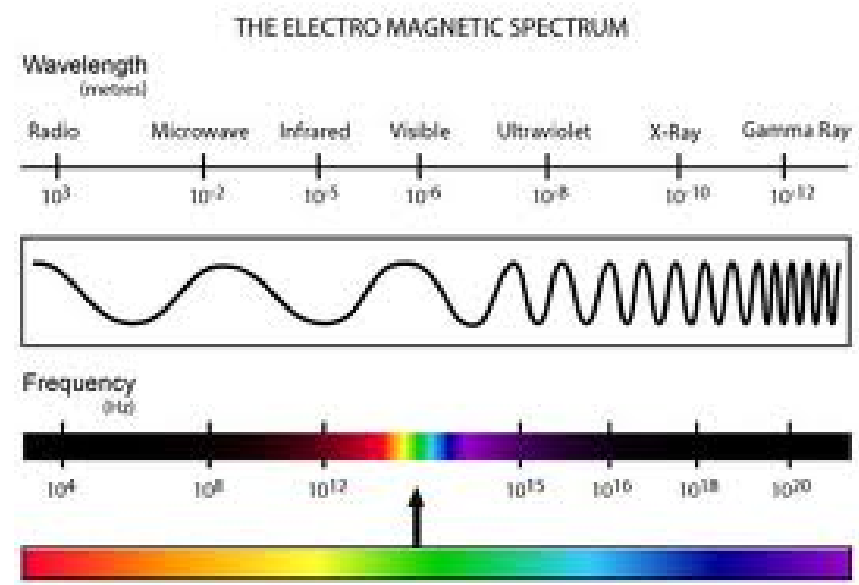


crest	top of a wave
trough	bottom of a wave
wavelength	distance between two crests or two troughs
amplitude	distance between the crest and the rest position or the trough and the rest position
frequency	the number produced per second, measured in Hertz (Hz)

Speed of wave (velocity)	=	frequency	x	wavelength
$v \text{ (ms}^{-1}\text{)}$	=	$f \text{ (Hz)}$	x	$\lambda \text{ (m)}$

Electromagnetic Waves

Electromagnetic waves are composed of electric and magnetic fields and do not need particles to transfer energy, that is they can travel through a vacuum. The electromagnetic spectrum contains several types of electromagnetic waves.



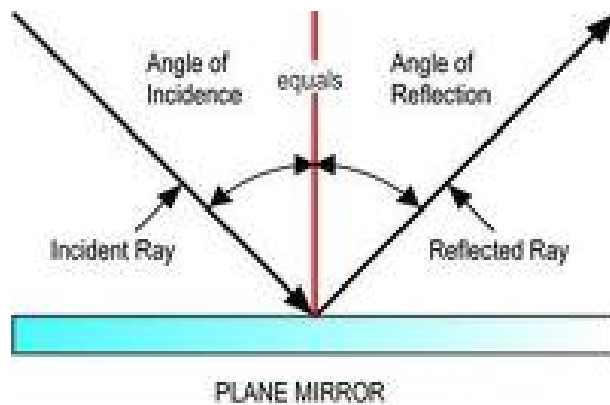
radio waves	transmit radio and TV signals, radar in air traffic control
microwaves	cooking, radar speed guns used by police
infrared waves	given off by hot objects, used to take temperature pictures and find people in collapsed buildings
visible light	seeing, photosynthesis, photography
UV rays	fluorescent lamps, sterilising
X rays	radiography, treating cancer, finding faults in metals, examining crystals
gamma rays	measure thickness of metals, sterilise medical equipment

Absorption And Reflection Of Colours In Light

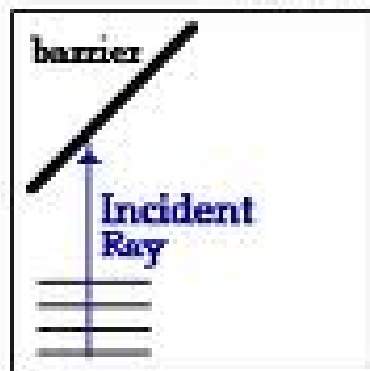
White light is made up of colours. When light hits a coloured object, that colour is reflected and all other colours in the light are absorbed by the object, eg. a red object

Reflection

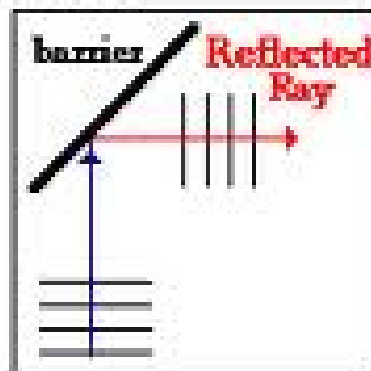
Law of Reflection states that when light waves hit a solid object, eg. a mirror, they are reflected at the same angle



The Law of Reflection



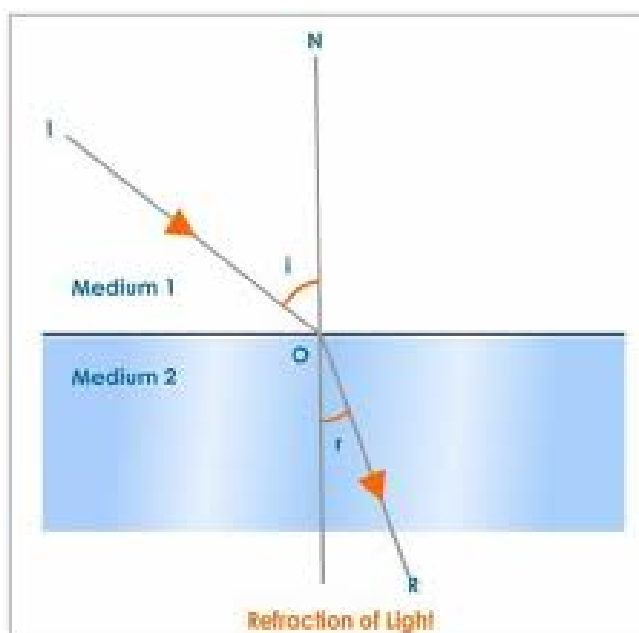
Before Reflection



After Reflection

Refraction

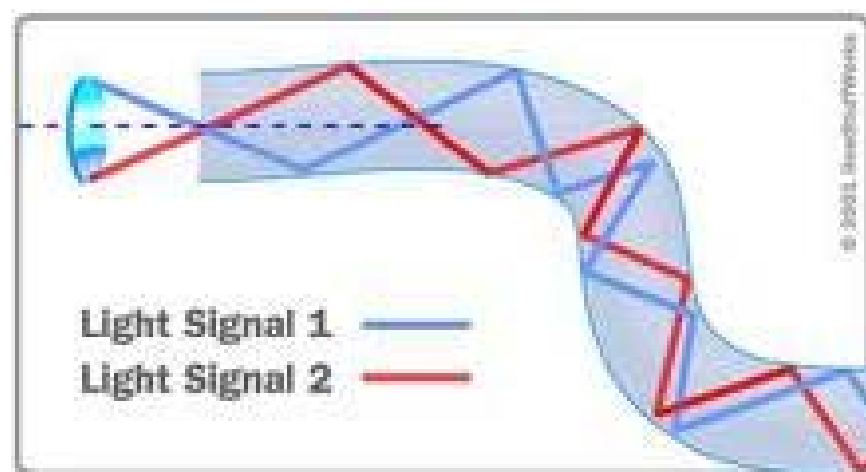
When waves pass from one medium to another, they change speed and direction. Refraction of light is used by lenses in eye glasses, binoculars, magnifying glasses, microscopes, telescopes and cameras.



Total Internal Reflection And Optical Fibres

When light enters a medium at an angle greater than the critical angle, it is reflected, not refracted. This is called total internal reflection and it is used in optical fibres in communication systems.

Optical fibres are fibres made of glass through which light travels by a process called total internal reflection. As light travels through the glass fibres, it continually hits the sides which causes it to be reflected back into the glass rather than being refracted out. By repeated reflections, the light travels along the optical fibre



Optical fibres are used to transmit sound and images over long distances. They are smaller, lighter, more flexible and more efficient than the electrical cables previously used for long distance telephone, radio and television communication.

Obtaining Information About The Universe

Some electromagnetic waves are used to provide information about the universe.

Radiowaves

Radiotelescopes collect radiowaves that allow astronomers to observe quasars, pulsars and clouds of hydrogen in space.

Infrared rays

Infrared telescopes collect infrared rays to allow astronomers to

- a) detect objects that are too cool to emit visible light
- b) measure the atmospheric temperature of the planets
- c) determine the temperature of background radiation in deep space

Visible Light

Optical telescopes detect visible light that allows astronomers to

- a) observe and measure planets, comets, stars and galaxies
- b) measure the colour and temperature of stars
- c) measure the red shift of space objects such as galaxies to determine the extent of expansion of the universe

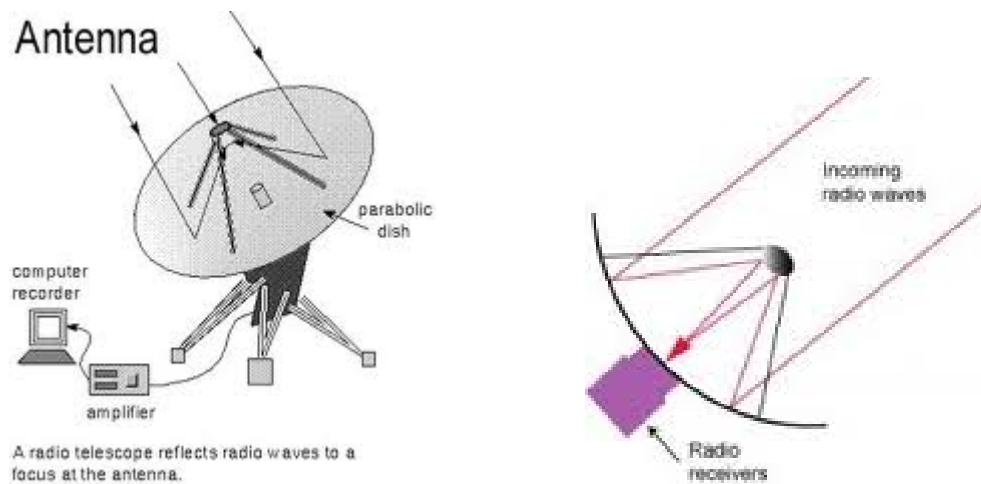
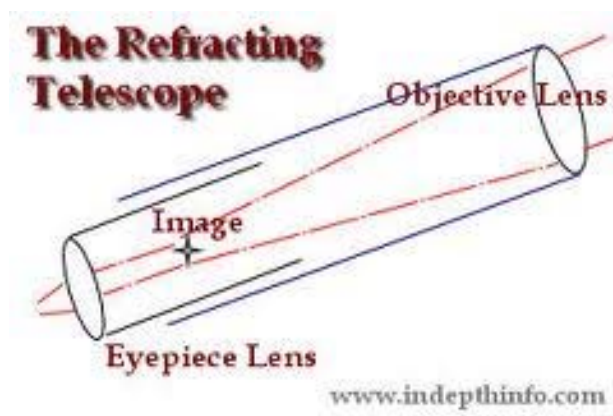


Figure above: radio telescopes



Problems In Obtaining Information About The Universe

Astronomers face some difficulties in obtaining information about the universe.

1. Visible light from city lights makes it difficult for optical telescopes to detect light from stars. For this reason, the telescopes are usually located in sparsely populated areas.
2. The atmosphere absorbs infrared rays, ultraviolet rays, X rays and gamma rays. It also scatters and refracts visible light. To overcome these problems, satellite telescopes, such as the Hubble Space Telescope, are located in space above Earth's atmosphere. This allows the telescopes to detect these electromagnetic waves without interference from the Earth's atmosphere. As a result, astronomers are able to gather much more information about the universe.

Stars

A light year is equal to the distance that light travels in one year and is commonly used to describe distances to stars.

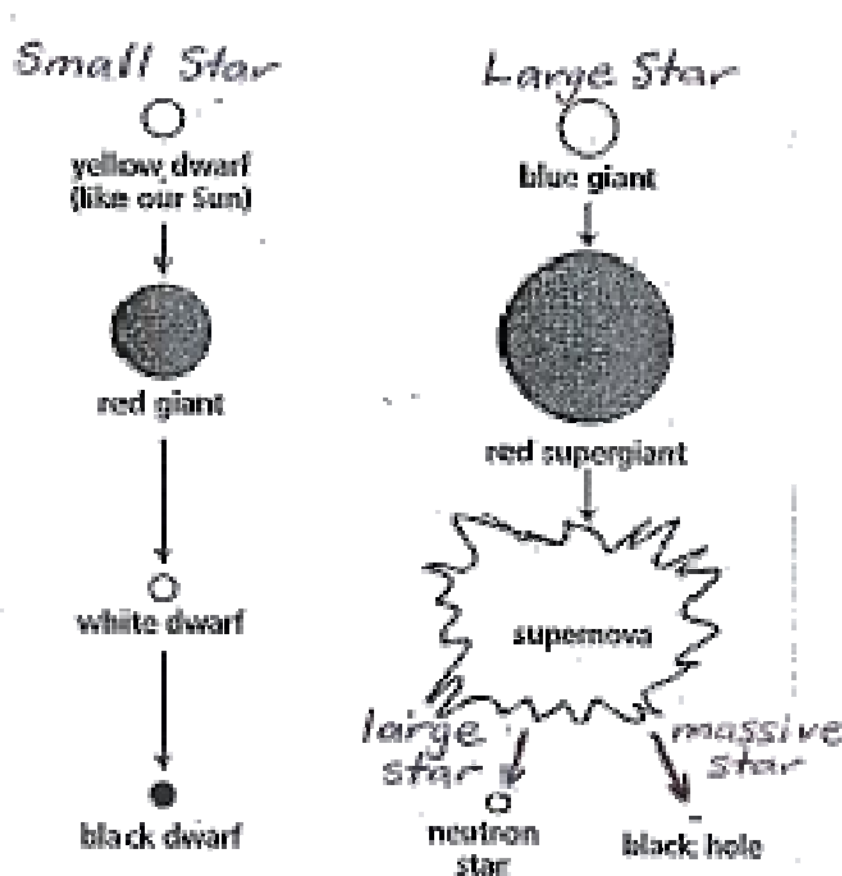
A galaxy consists of thousands and millions of stars. Our sun is a small star on the edge of the Milky Way galaxy. Galaxies come in several different shapes – elliptical, ordinary spiral, barred spiral.

Birth And Death Of Stars

Stars are believed to form when huge clouds called nebulae shrink and the gas particles in them attract each other by their individual tiny gravitational forces. The star then burns hydrogen as fuel.

A medium star like our sun burns for billions of years and then expands to become a red giant. Eventually the star runs out of fuel and it collapses and shrinks. It slowly cools forming a white dwarf and then a dead black dwarf.

A large star called a blue giant burns for a few million years and then expands to become a red giant. Eventually the core runs out of fuel and as the star collapses it forms an exploding supernova that becomes a black hole or a neutron star. Pulsars are neutron stars that emit beams of radio waves that are detected by telescopes.



Origin Of The Universe - Big Bang Theory

The Big Bang theory suggests that the universe began about 14 billion years ago with a huge explosion called the Big Bang. Either all of the material was created in an instant of time and was sent outwards in an enormous explosion or the matter existed in one spot and the Big Bang explosion sent it expanding outwards. Several observations of the universe provide evidence for the Big Bang.

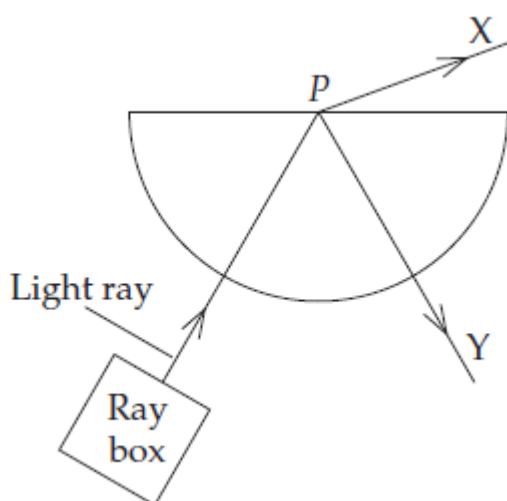
1. In 1929, Edwin Hubble studied the spectra of light emitted by stars and galaxies and observed that their dark spectral lines moved towards the red end of the light spectrum. This effect is called red shift and from it he concluded that most stars are moving away from Earth at high speed. This suggests that the universe is expanding, as would be expected after an explosion.
2. By imagining all of the stars and galaxies moving at their current speed but backwards, astronomers have calculated that they would all arrive back at the same spot at the same time. From this they believe that all matter in the universe must once have been so close together that it all fitted inside a pinhead before exploding out in the Big Bang.
3. Astronomers reasoned that if the Big Bang theory is correct then the beginning of the universe would have involved a lot of energy. As the universe grew larger and cooled, this energy would have cooled to cosmic microwave background radiation (CMBR). In 1964, two astronomers detected some CMBR. Later in 1990, a satellite was launched to measure CMBR, subsequently proving that the intensity of the radiation was consistent with the expansion and cooling of space following a very hot "explosion" billions of years ago.

Revision Questions

1. What do waves carry?
2. Draw a wave and label the wavelength.
3. Define the following words:
 - (a) wavelength
 - (b) frequency
4. Name TWO waves in the electromagnetic spectrum?
5. Describe TWO uses of electromagnetic waves? Describe their use in communication.
6. What is meant by the following terms:
 - (a) reflection
 - (b) refraction
 - (c) absorption
7. Why does an apple look red?
8. Why does a white shirt look white?
9. Why does a black car look black?
10. Draw a ray diagram to show the reflection of light from a plane mirror.
11. State the Law of Reflection.
12. Identify some uses of plane and curved mirrors.
13. Draw a ray diagram to show the refraction of light travelling from air into water.
14. Identify some uses of curved mirrors.
15. Explain how light travels through optical fibres.
16. How do scientists obtain information about the universe?
17. Describe ONE difficulty they face in obtaining information about the universe.
18. What does the Big Bang theory propose about the origin of the universe?
19. Discuss one piece of evidence used to support the Big Bang theory.
20. Describe some changes that take place in the life of a star.

1) **Multiple Choice**

- i) Which observation made by astronomers supports the Big Bang theory?
- (A) Galaxies have stopped moving.
 (B) Galaxies are colliding with each other.
 (C) Galaxies are moving towards each other.
 (D) Galaxies are moving away from each other
- ii) The diagram shows a ray of light passing through a semicircular piece of glass.



At point *P* two light rays are produced, X and Y.

What are the processes that produce ray X and ray Y?

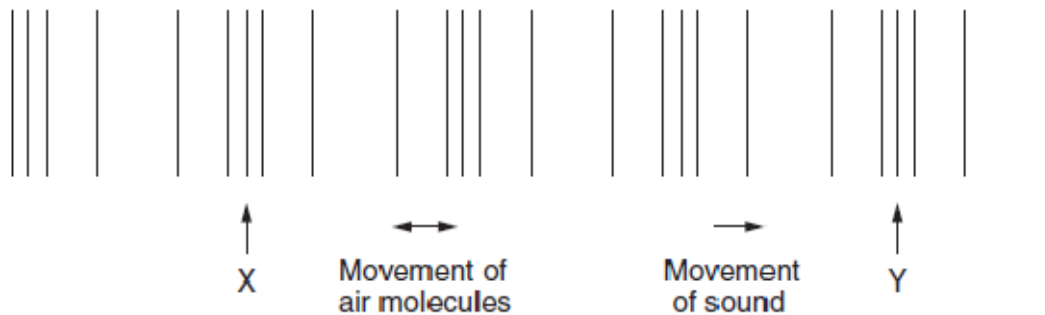
	<i>Process that produces ray X</i>	<i>Process that produces ray Y</i>
(A)	Absorption	Reflection
(B)	Reflection	Refraction
(C)	Refraction	Absorption
(D)	Refraction	Reflection

- iii) Using light to transmit information through fibre-optic cables is an example of
- (A) renewable energy.
 (B) nuclear technology.
 (C) electromagnetic absorption.
 (D) communications technology

- iv) In normal light, a blue shirt appears blue.
What properties of light account for the appearance of the shirt?
- (A) Absorption and refraction only
(B) Reflection and absorption only
(C) Refraction and reflection only
(D) Refraction, reflection and absorption
- v) Which of the following lists contains ONLY forms of electromagnetic radiation?
- (A) Infrared, sound, ultraviolet
(B) Sound, x-rays, gamma rays
(C) Infrared, seismic, microwaves
(D) Gamma rays, ultraviolet, x-rays

2) **One word Answers**

The diagram represents a sound wave travelling through air.



How many complete wavelengths are shown between points X and Y?

1) Multiple Choice

i) What is one use for X-rays?

- (A) Scanning barcodes
- (B) Home alarm systems
- (C) Operating remote controls
- (D) Making images of skeletons

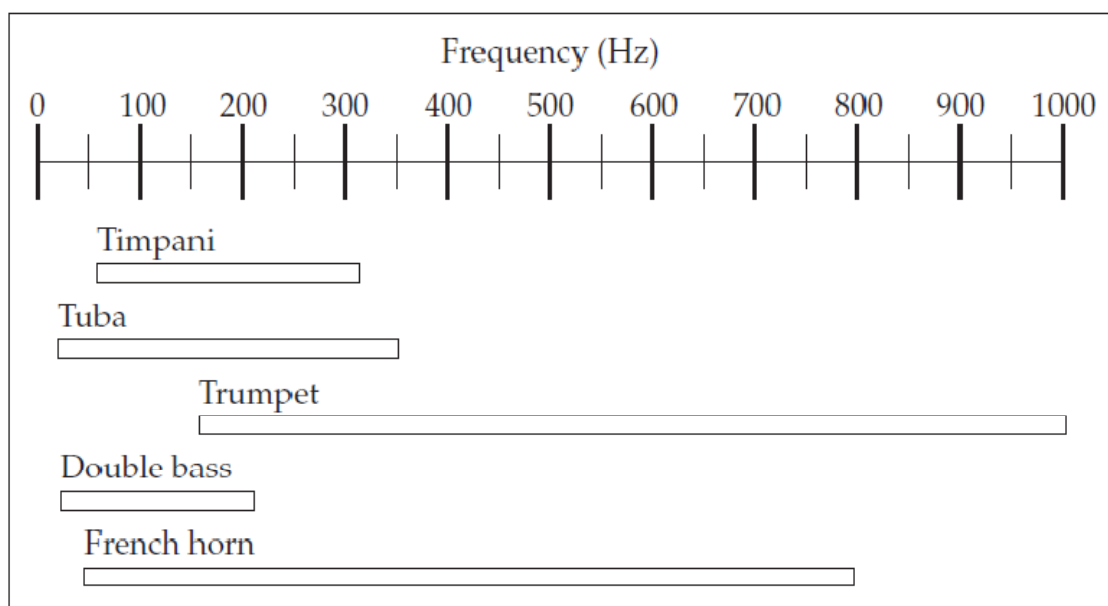
ii) Mobile phones use microwaves to send information to a transmitter.

What type of energy is used to carry the information from the mobile phone to a transmitter?

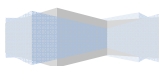
- (A) Electromagnetic
- (B) Heat
- (C) Light
- (D) Sound

Use the diagram below to answer the next two questions

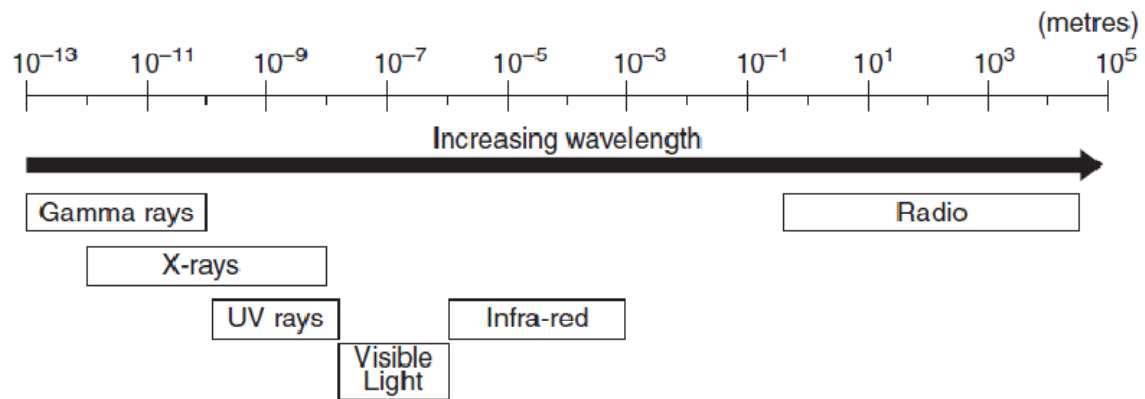
The chart shows the range of frequencies that some musical instruments can produce.



- iii) Which instrument has the smallest frequency range?
- (A) Double bass
 - (B) French horn
 - (C) Timpani
 - (D) Tuba
- iv) Which frequency can be produced on four of the five instruments?
- (A) 100 Hz
 - (B) 325 Hz
 - (C) 400 Hz
 - (D) 750 Hz
- v) What is the *frequency* of a wave?
- (A) The speed of the wave
 - (B) The direction of the wave
 - (C) The distance between wave crests
 - (D) The number of vibrations each second
- vi) (Refer to stimulus booklet to answer this question)
- What do we call the bending of light that is occurring at Point A?
- (A) Absorption
 - (B) Reflection
 - (C) Refraction
 - (D) Transpiration



vii) The diagram shows the waves that make up the electromagnetic spectrum.



What is the approximate wavelength (in metres) of the waves that can be used to produce electricity from SLIVER[®] cells?

- (A) 10^{-10}
- (B) 10^{-7}
- (C) 10^{-5}
- (D) 10^{-1}

viii) Refer to the stimulus booklet to answer the next three questions

What is the highest setting on the volume control of a MP3 player that is unlikely to cause hearing loss?

- (A) 40%
- (B) 65%
- (C) 80%
- (D) 100%

ix) What is the minimum loudness of a 2000 Hz sound that person Y can hear?

- (A) 0dB
- (B) 40 dB
- (C) 50 dB
- (D) 70 dB

- x) Person Y played their MP3 player at the loudness of a normal conversation. Which frequencies can they hear?

- (A) All
- (B) None
- (C) Less than 4000 Hz
- (D) Greater than 4000

2) One word Answers

- i) What is the name given to the current scientific theory to explain how the universe began?

(Refer to stimulus booklet for the next 2 questions)

- ii) What term is used to describe the behaviour of light at point B on the diagram?
- iii) Ear muffs must be used when operating a jack hammer. By how many decibels must the loudness of sound be decreased to prevent hearing loss?

3) Short Answer questions

(Refer to stimulus booklet to answer the question)

- i) There is a proposal to limit the loudness of MP3 players to less than 80 dB. Explain why this proposal would benefit MP3 users or the rest of society.

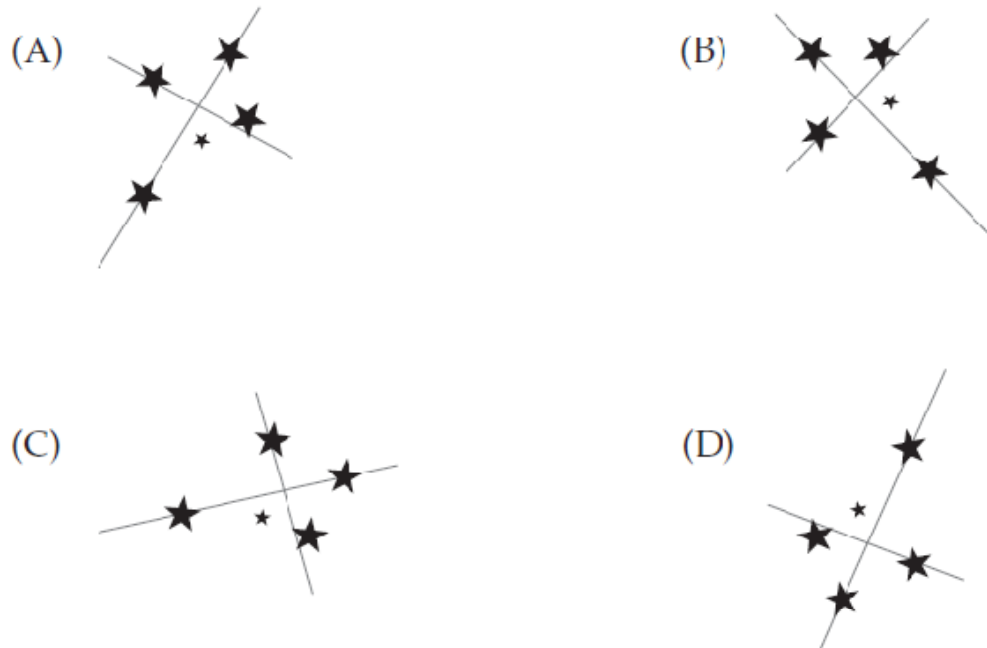
School Certificate 2008

1) Multiple Choice

- i) The Southern Cross is a constellation of stars in the night sky in the Southern hemisphere. It appears to rotate around a point in the sky in a clockwise direction and completes a whole revolution every 24 hours.



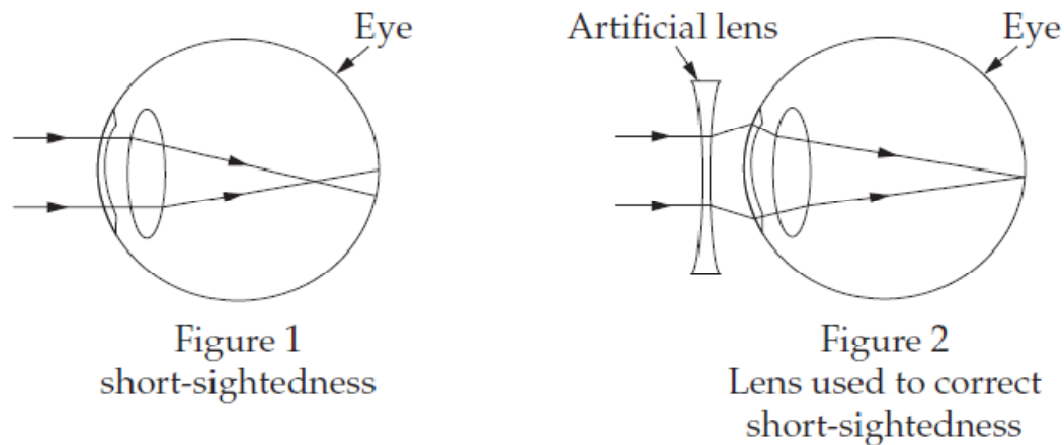
If the constellation appears as shown in the diagram above at 6 pm, what will it look like at 9 pm on the same night?



ii) Our sun is a medium size star. As it gets older it will use up its fuel. What is most likely to happen during the next stage of its life?

- (A) Contract
- (B) Expand
- (C) Explode
- (D) No change

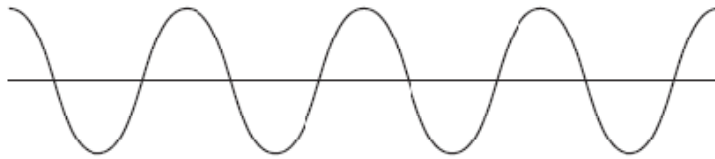
iii) The figures show how a lens can be used to correct short sightedness.



What is the purpose of the artificial lens in Figure 2?

- (A) To absorb the light rays
- (B) To reflect the light rays
- (C) To refract the light rays
- (D) To scatter the light ray

- iv) The relationship between frequency (f), wavelength (λ) and speed (v) is represented by the formula $v = f\lambda$.



DRAWN TO
SCALE

The wave shown has a frequency of 10 Hz.

Measure the wavelength and then using the formula calculate the speed of the wave.

- (A) 2 cm/s
 - (B) 5 cm/s
 - (C) 10 cm/s
 - (D) 20 cm/s
- v) An astronomical observatory is being built in Antarctica. Its location is 4100 metres above sea level at one of the calmest, coldest places on Earth. The observatory will be controlled by satellite.
- Why is this observatory being built in Antarctica?
- (A) The extreme cold will aid light absorption.
 - (B) The atmosphere is unpolluted and will allow clearer images to be obtained.
 - (C) The hole in the ozone layer will allow astronomers to gather more information.
 - (D) The altitude and polar location mean it is closer to some stars, allowing them to be seen in greater detail
- vi) What does the Big Bang theory explain?
- (A) The formation of Earth
 - (B) The formation of stars
 - (C) The formation of the solar system
 - (D) The formation of the universe
- vii) What type of waves are radio waves?
- (A) Electromagnetic
 - (B) Electrostatic
 - (C) Gravitational
 - (D) Sound

viii) (Refer to stimulus booklet to answer the question)

A sunscreen is effective in blocking UV rays of wavelengths 280 nm – 430 nm.
Which types of ultraviolet rays are blocked by the sunscreen?

- (A) UVA and UVB
- (B) UVB and UVC
- (C) UVA and UVC
- (D) UVA, UVB and UVC

2) Short Answer Questions

- i) Suggest why people have a greater risk of sunburn at 12 noon than at 7 am.
- ii) Explain why outdoor activities at school should be limited to the early morning

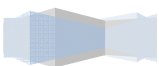
School Certificate 2007

1) Multiple Choice

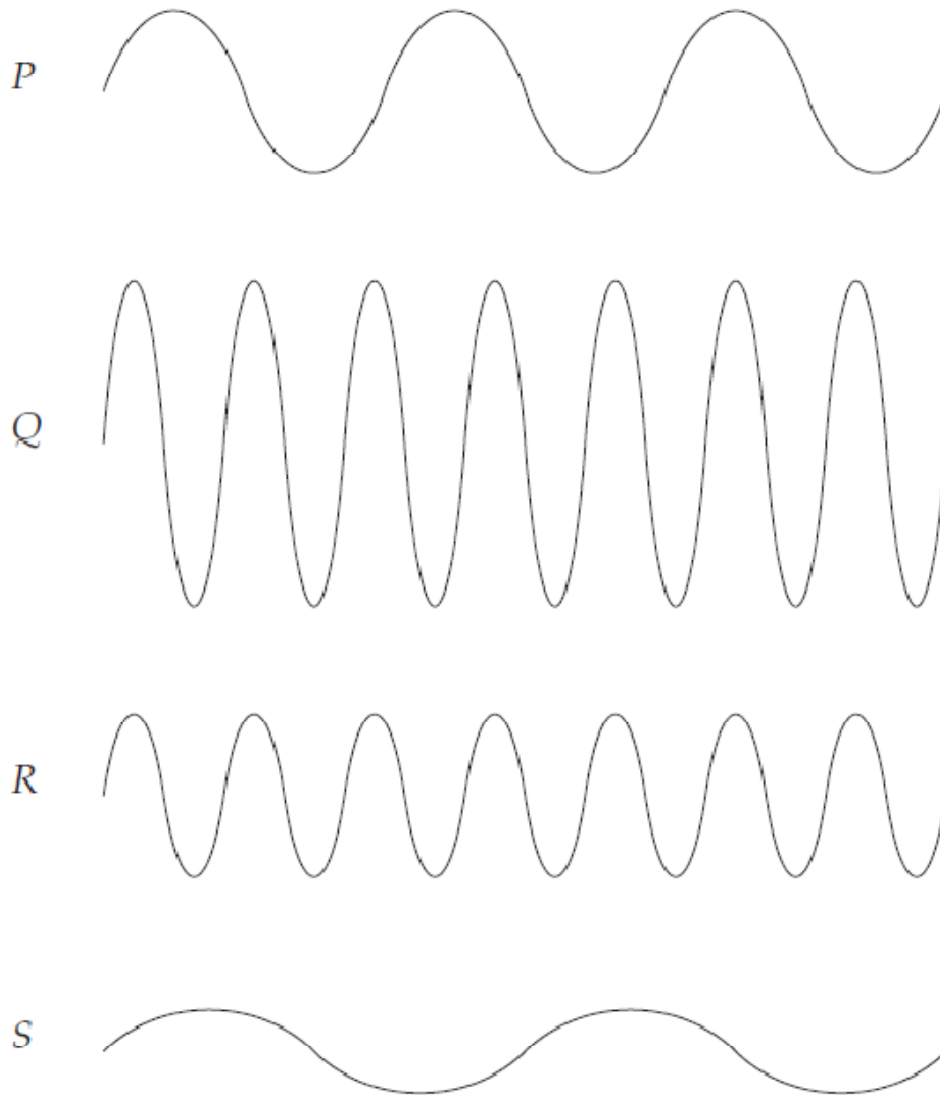
- i) (Unfortunately the diagram is still “awaiting copyright”)

Which property of light is being used to direct the light onto the receiver?

- (A) Absorption
- (B) Conduction
- (C) Reflection
- (D) Refraction



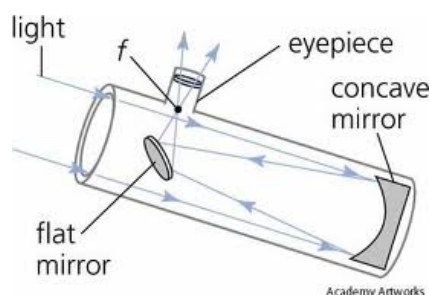
ii) The diagram shows four light waves drawn to the same scale.



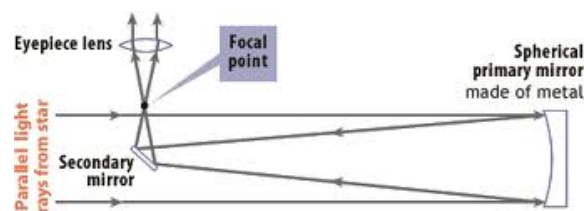
Which statement about the waves is correct?

- (A) *P* and *R* have the same energy but different frequencies.
- (B) *R* and *S* have the same energy but different frequencies.
- (C) *Q* and *S* have different energy but the same frequency.
- (D) *P* and *Q* have the same energy and the same frequency

- iii) The diagram shows two types of telescope



Type 1



Type 2

What is the main difference between these two types of telescope?

- (A) Type 1 uses refraction and Type 2 uses reflection.
 - (B) Type 1 uses reflection and Type 2 uses refraction.
 - (C) Type 1 focuses light but Type 2 does not.
 - (D) Type 1 does not focus light but Type 2 does.
- iv) A security alarm uses a sensor that measures the amount of infrared radiation reaching it. The alarm is set off when a warm object enters the room and an increase in infrared radiation is detected. It is possible to stop the alarm working by placing a sheet of clear glass in front of the sensor.

What is the most likely reason for the glass having this effect?

- (A) The glass absorbs the infrared radiation.
 - (B) The glass reflects the infrared radiation.
 - (C) The glass absorbs visible light and gives off infrared radiation.
 - (D) The infrared radiation has to travel around the edges of the glass.
- v) Which of the following factors makes it difficult for astronomers to gather information about the Universe?
- (A) Sound produced by aeroplanes
 - (B) The number of stars in the sky
 - (C) Light from towns and cities
 - (D) Radiowaves from space

vi) What is the most widely held scientific theory about the origin of the Universe?

- (A) Oscillating Model
- (B) Plate Tectonics
- (C) Steady State
- (D) Big Bang

vii) Police use two types of speed detection devices in NSW:

RADAR – stands for ‘RADio Detection And Ranging’, and

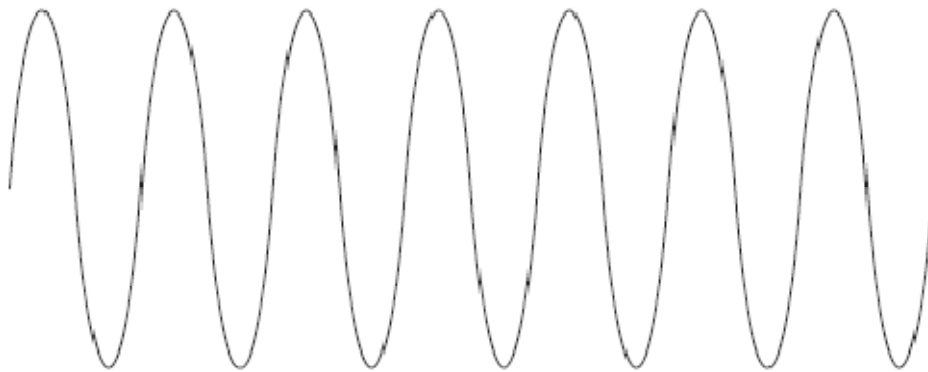
LIDAR – stands for ‘LIght Detection And Ranging’, commonly known as a ‘laser gun’.

Which speed detection device uses electromagnetic radiation?

- (A) LIDAR
- (B) RADAR
- (C) Both devices
- (D) Neither device

2) *One word Answers*

i) What is the wavelength in millimetres of the wave shown?



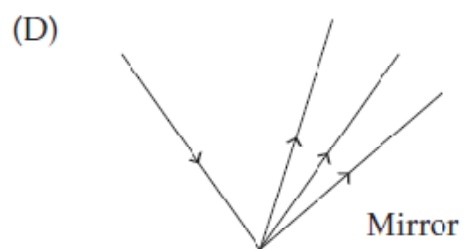
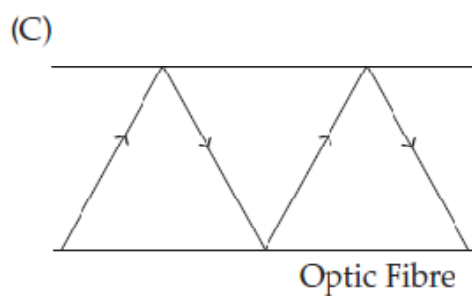
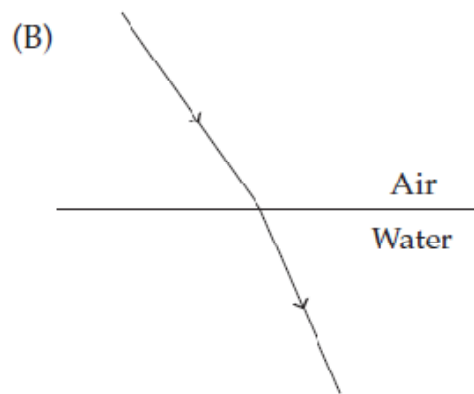
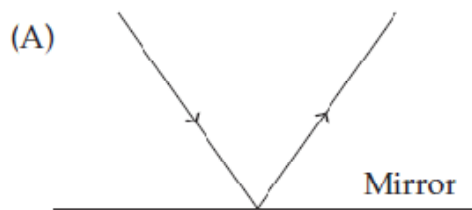
3) *Short Answer Questions*

i) Satellites emit microwave radiation to transfer information.

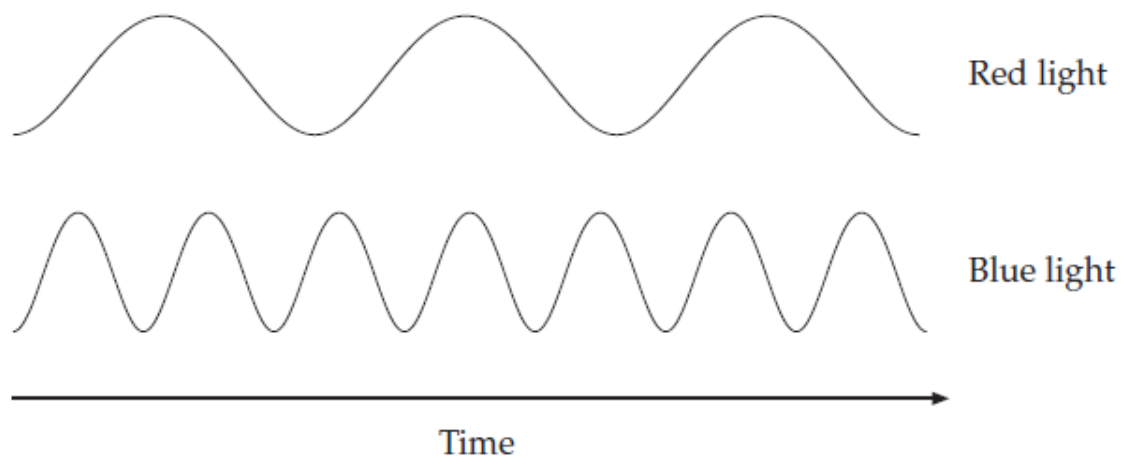
Identify another relevant communication technology involving electromagnetic radiation and give ONE feature of this application.

1) **Multiple Choice**

i) Which diagram represents refraction of light?



ii) The diagram represents light waves emitted from two light globes. One globe is red, the other is blue.



Which statement is correct?

- (A) The blue light has a higher frequency than the red light.
 - (B) The blue light has a longer wavelength than the red light.
 - (C) The blue light has the same frequency as the red light.
 - (D) The blue light has the same wavelength as the red light.
- iii) The Big Bang theory states that the universe has been growing larger since its beginning.
Which of the following provides the best evidence to support this theory?
- (A) The structure of galaxies
 - (B) The high temperature of stars
 - (C) The large distances to other stars
 - (D) The directions in which galaxies are moving

2) *One word Answers*

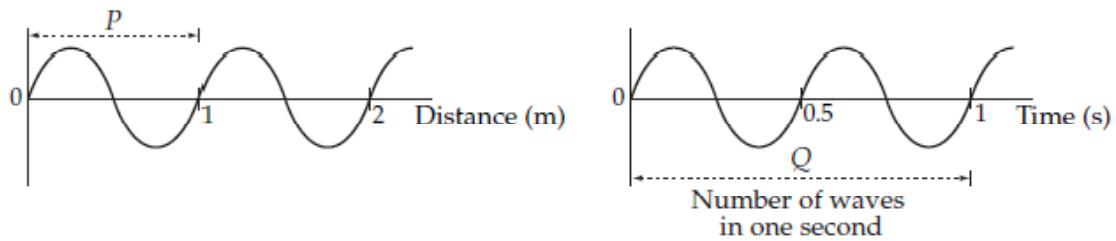
- i) What do tsunami waves carry which is common to all waves?
- ii) When a star like the Sun uses up most of its fuel, it changes colour from yellow to red.
What has changed on the surface of the star to cause this colour change?

School Certificate 2005

1) *Multiple Choice*

- i) Which of the following wave types is unlikely to provide scientists on Earth with information about a distant star?
 - (A) Gamma
 - (B) Radio
 - (C) Sound
 - (D) Ultraviolet
- ii) Which of the following shows part of the life cycle of a star such as the Sun?
 - (A) dust cloud → yellow star → red giant
 - (B) dust cloud → red giant → yellow star
 - (C) red giant → yellow star → dust cloud
 - (D) red giant → dust cloud → yellow star

- iii) The diagrams below represent a wave.

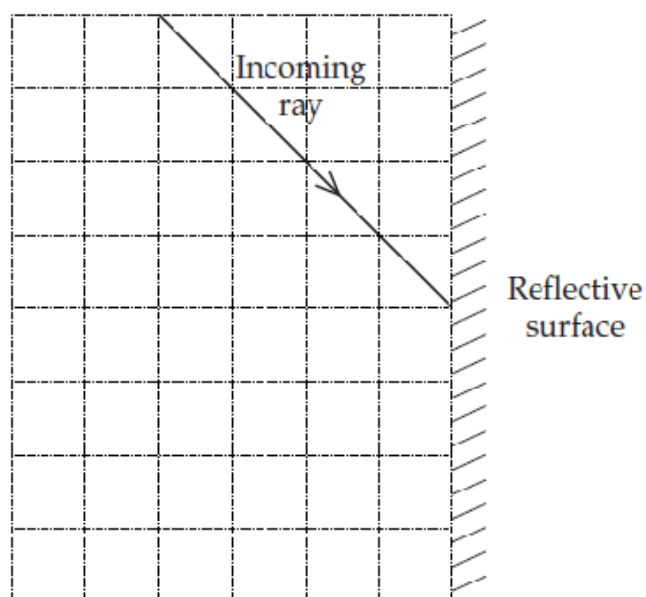


What features of the wave are represented by *P* and *Q*?

	P	Q
(A)	Wavelength	Frequency
(B)	Frequency	Wavelength
(C)	Speed	Wavelength
(D)	Wavelength	Speed

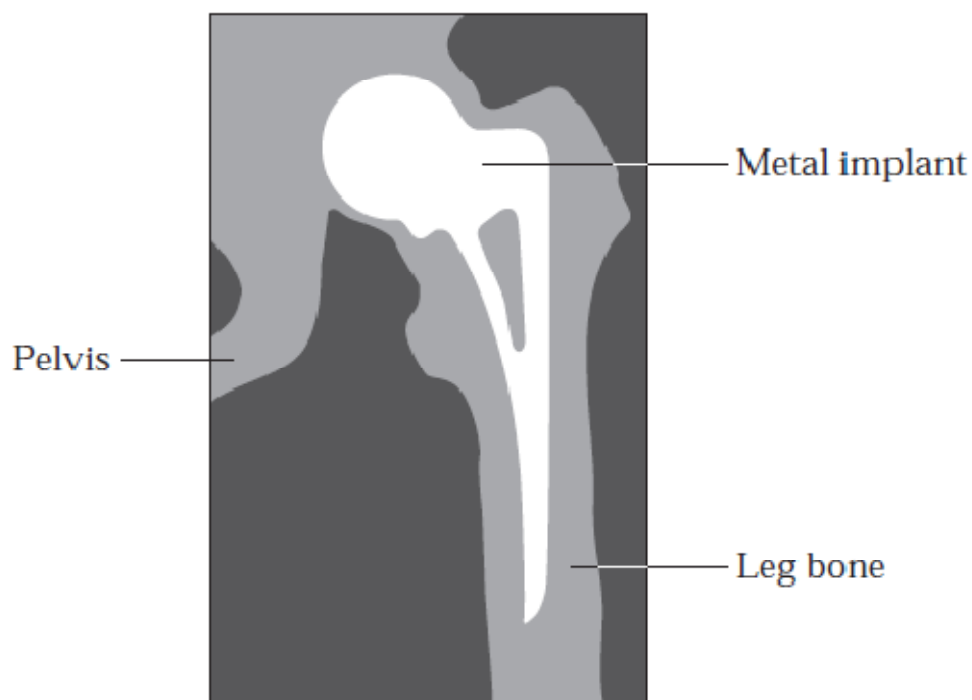
2) Short Answer Questions

- Name a type of electromagnetic radiation that is used in communication.
- Identify ONE advantage and ONE disadvantage of using this type of electromagnetic radiation for communication.
- The diagram shows an electromagnetic ray hitting a reflective surface. Complete the diagram by drawing a line to show the reflected ray.



1) Multiple Choice

- i) The diagram shows an X-ray photograph of a metal implant in a hip joint



Why can we see the implant on the X-ray photograph?

- (A) X-rays are blocked by the implant.
- (B) X-rays make the implant radioactive.
- (C) X-rays can pass through tissue, bone and the implant.
- (D) X-rays are a low-energy form of electromagnetic energy.

2) One Word Answers

- i) What term is used to describe the number of waves passing a certain point in each second?
- ii) We see words on a page because light bounces off the page. What property of light is responsible for this?

Glossary

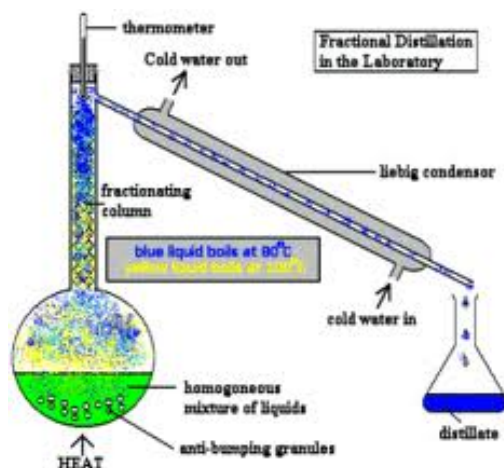
frequency, wavelength, electromagnetic radiation, electromagnetic spectrum, absorption, reflection, refraction, radiotelescope, refracting telescope, red giant, supernova, white dwarf, black dwarf, black hole, neutron star, pulsar, Big Bang theory

Energy Resources

Fuels And Combustion

Some common fuels obtained from the fractional distillation of petroleum are the alkanes:-

- ☺ Gases - methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10})
- ☺ Liquids – pentane (C_5H_{12}), hexane (C_6H_{14}), heptane (C_7H_{16}), octane (C_8H_{18}) which are used to make petrol

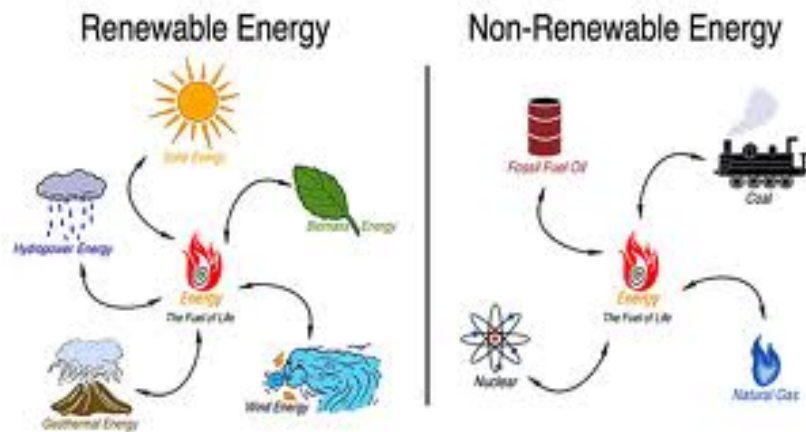


Combustion – is a chemical reaction in which the above fuels combine with oxygen to release energy in the form of heat and produce CO_2 and H_2O .



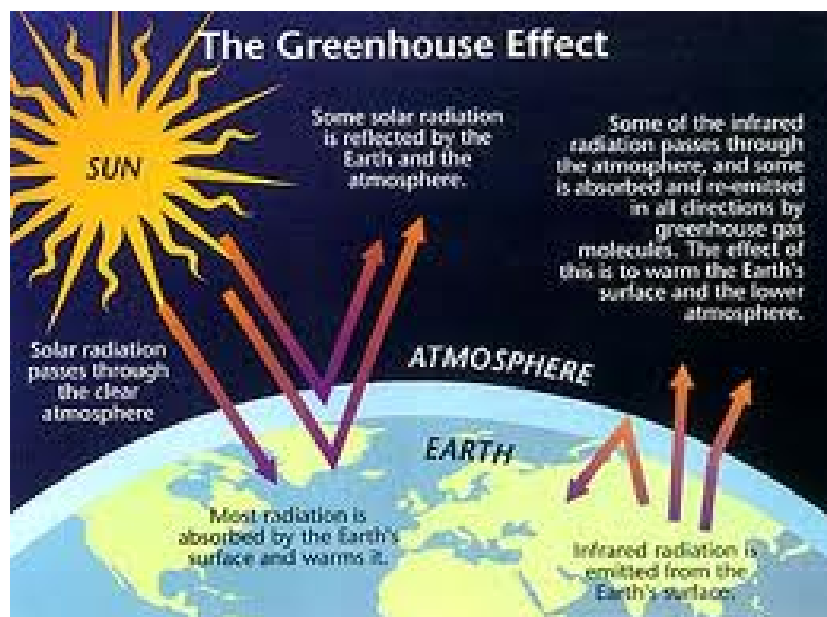
Energy And Fuels

Energy is an important resource because it enables us to do work. Much of our energy comes from the non-renewable fossil fuels, coal, petroleum and natural gas. Coal is used in power stations to generate electricity, petrol and diesel from petroleum are used as fuel in vehicles and natural gas is used for cooking and heating.



Greenhouse Effect

The earth has a normal greenhouse effect – a layer of CO₂ in the atmosphere allows some heat from the sun to radiate from the earth back out into space, keeping the earth's temperature in a suitable range for plants and animals to thrive. However, the excessive burning of fossil fuels is enhancing the greenhouse effect. The combustion of these fuels produces CO₂ which is released into the atmosphere. As this CO₂ layer increases in size, less of the sun's heat is radiated back into space. Instead it is trapped on the Earth, causing the Earth to get hotter (global warming) and experience climate change, which in turn damages ecosystems.



Alternative Renewable Energy Sources

Alternative energy sources such as solar energy, wind power and hydroelectricity can be used to generate electricity. There are several advantages with all three sources. Firstly, they are all renewable. In sunny areas, there are long periods of sunlight during which solar energy falls on solar cells and is converted to electrical energy. In windy areas, there is a continuous supply of wind to turn the blades of the wind generators. In

mountainous areas with high precipitation, there is plenty of water to generate hydroelectricity.

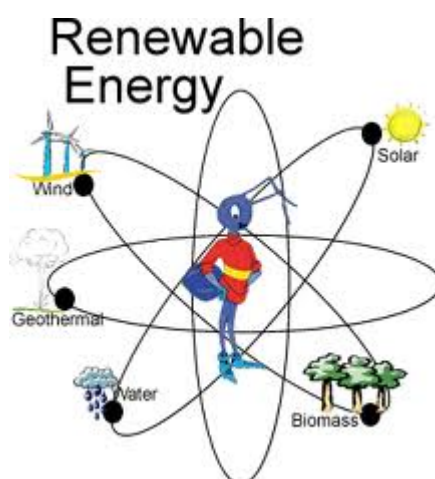
Secondly, they do not contribute to the greenhouse effect. Unlike fossil fuels, these energy sources do not produce CO_2 in the course of electricity production. Consequently, they do not contribute to the greenhouse effect.

There are however some disadvantages associated with these energy sources.

Firstly, solar cells are only useful in areas that have plenty of sunlight. When solar energy strikes solar collectors, it is converted to electrical energy, but when the amount of sunlight is reduced by cloud cover or other factors, then the amount of electrical energy is also reduced. As a result, the electricity supply does not meet demand and so needs a backup supply.

Secondly, some people consider wind generators to be visual pollution of the landscape. These generators are large towers with three long blades attached at the top. They are commonly white in colour and are placed on high points in the landscape. As a result, they can be seen over large distances and change the appearance of the landscape in a way that some people dislike.

Thirdly, the construction of hydroelectricity dams and pipelines damages ecosystems. Trees are cleared to lay pipelines and valleys are flooded to build dams. Both of these cause enormous destruction to the vegetation which results in much habitat loss leading to large loss of animal life.



Revision Questions

1. Identify the name and formula for the first eight alkanes.
2. What happens in a combustion reaction?
3. Write word equations for the combustion of
 - a) magnesium
 - b) methane
 - c) butane
 - d) octane
4. Name two fossil fuels.
5. Describe some uses of coal and petroleum in the production of energy by combustion.
6. Define the term “air pollution”.
7. Explain how carbon dioxide produced in the combustion of fossil fuels contributes to the greenhouse effect.

8. Identify two renewable energy sources used to generate electricity.
9. Why are they called “renewable” sources?
10. Discuss the use of one of these renewable energy sources as a way of generating electricity without contributing to the greenhouse effect.

Glossary

hydrocarbon, combustion, fossil fuel, pollution, greenhouse effect, renewable

School Certificate 2010

1) Multiple Choice

- i) Which of the following gases in Earth’s atmosphere is believed to be a major contributor towards a greenhouse effect?

- (A) Ozone (O₃)
- (B) Nitrogen (N₂)
- (C) Carbon dioxide (CO₂)
- (D) Chlorofluorocarbon (CFC)

(Refer to stimulus booklet to answer the next two questions)

- ii) Why is coal gasification known as ‘clean’ coal technology?

- (A) The coal is washed before it is used.
- (B) The process produces more electricity.
- (C) The products of burning coal are not directly released into the environment.
- (D) There are no gas emissions from the process being released into the environment.

- iii) Coal-fired power stations are often located near lakes.
Which of the following is the most important reason for building coal-fired power stations near a water source?

- (A) Water is needed to cool steam.
- (B) Water from the lake drives the generator.
- (C) The power station releases pollutants into the lake.
- (D) Water from the lake is used to put out fires in the power station.

2) Short Answer Questions

(Refer to stimulus booklets to answer the following questions)

- i) Construct a table that shows the materials that are required and the products that are produced in both a coal-fired power station and a clean coal power station.
- ii) How can the use of clean coal technology benefit the environment?
- iii) Why are saucepan handles made from thermosetting plastic?
- iv) A biopolymer is a plastic that is biodegradable. This means that it can be broken down by organisms living in the soil.

Identify an advantage and a disadvantage of using biopolymers.

- v) Scientific research and its applications have many implications for society and the environment.

Some examples of scientific research are:

- Stem cell research
- Nuclear energy and the atomic bomb
- The use of pesticides
- Genetically modified organisms
- The use of microwaves in ovens and mobile phones.

Describe the beneficial and harmful impacts of an area of scientific research and its application.

School Certificate 2009

1) Multiple Choice

- i) What does the word *combustion* refer to?
 - (A) The burning of a compound in oxygen
 - (B) A reaction that involves heat and smoke
 - (C) A reaction that involves hot acids and bases
 - (D) The flames that result when something burns

- ii) Which process involves plants using carbon dioxide?
- (A) Burning
 - (B) Decay
 - (C) Photosynthesis
 - (D) Respiration
- iii) Which processes add carbon dioxide to the atmosphere?
- (A) Burning, decay and respiration
 - (B) Burning, decay and photosynthesis
 - (C) Respiration, decay and photosynthesis
 - (D) Burning, photosynthesis and respiration
- iv) Organisms involved in decay are called decomposers.
- What role do decomposers play in the carbon cycle?
- (A) They provide food for animals.
 - (B) They allow carbon to be reused.
 - (C) They limit the number of plants in an ecosystem.
 - (D) They remove carbon dioxide from the atmosphere.
- v) Why is fermentation an example of biotechnology?
- (A) The products can be consumed.
 - (B) Grape vines are a renewable resource.
 - (C) Living things are used in this process.
 - (D) Living things are not harmed in this process

2) *Short Answer Questions*

- i) Some alternative energy sources are nuclear energy, wind energy and solar energy.

Evaluate the environmental impacts of replacing fossil fuels with alternative energy sources.

School Certificate 2008

1) *Multiple Choice*

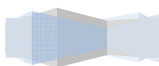
- i) The burning of coal in power stations produces carbon dioxide.

Which chemical reaction produces the carbon dioxide?

- (A) Acidification
- (B) Combustion
- (C) Decomposition
- (D) Neutralisation

- ii) Which material is recycled in sewage treatment?

- (A) Clarified sewage
- (B) Digested sludge
- (C) Flocculant
- (D) Magnetite



- iii) Methane produced in sewage treatment can be used as an alternative energy source.
What is an advantage of using sewage instead of fossil fuels as a source of methane?
- (A) Digested sludge is used in potting mix.
(B) Methane from sewage is non-renewable.
(C) Fossil fuel sources of methane will run out.
(D) The methane from sewage will not pollute.
- iv) Which is the best explanation of the greenhouse effect?
- (A) A decrease in carbon dioxide in the atmosphere traps more heat and allows more ultraviolet radiation to reach Earth's surface.
(B) An increase in the ozone layer decreases the amount of ultraviolet radiation that reaches Earth's surface.
(C) A decrease in the ozone layer allows more radiation to reach Earth's surface.
(D) An increase in carbon dioxide in the atmosphere traps more heat radiation from Earth.

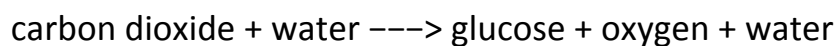
2) **Short Answer Questions**

- i) Name an environmental advantage of using CFL bulbs and explain why it is a benefit.
- ii) A significant issue facing Australia is the provision of adequate water supplies. Some strategies to address this issue that have been discussed in the media are:
- increasing water storage
 - decreasing water usage
 - increasing water collection options
 - recycling.

Describe TWO environmental problems associated with any of the strategies listed above and identify a suitable strategy for providing water in the future, giving reasons for your choice.

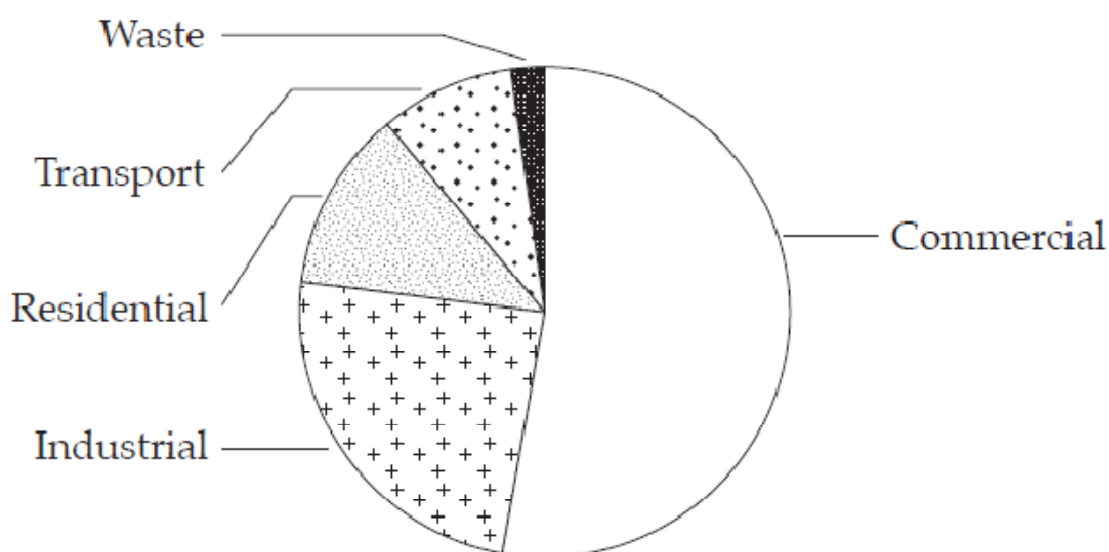
1) Multiple Choice

- i) The word equation for photosynthesis is:



What are the reactants for photosynthesis?

- (A) Oxygen and glucose
 - (B) Carbon dioxide and water
 - (C) Light, oxygen and glucose
 - (D) Light, carbon dioxide and water
- ii) The sector graph shows the five main sources of greenhouse gases emitted by the city of Sydney in 2004.



What approximate percentage did industrial activities contribute?

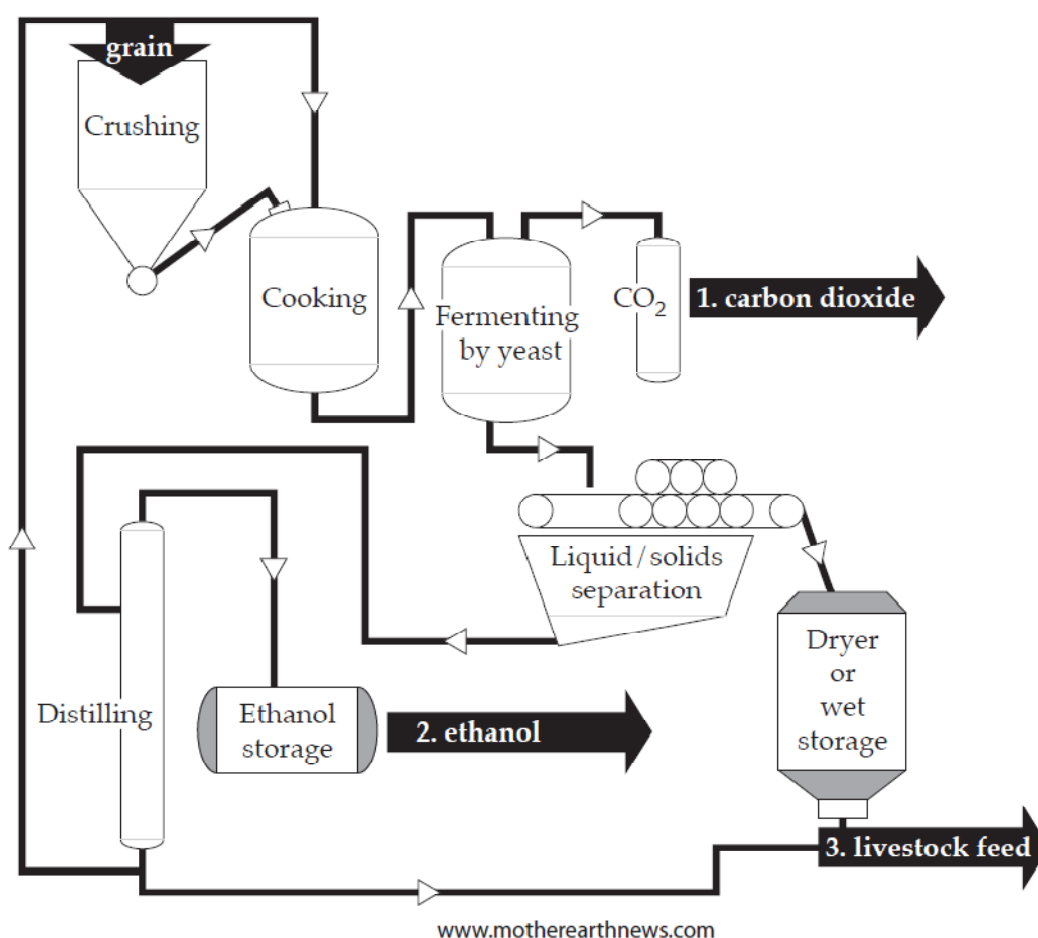
- (A) 26
- (B) 33
- (C) 53
- (D) 69

- iii) As a car is driven, the amount of fuel in the tank decreases.

What happens to the fuel in the engine?

- (A) It burns in the engine and releases carbon dioxide.
(B) It burns in the engine to form carbon dioxide and water.
(C) It is neutralised in the engine to form carbon dioxide and water.
(D) It burns in the engine and becomes the fuel vapour in exhaust gases.
- iv) The diagram shows a flow chart for the production of ethanol from grain by yeast (a type of micro-organism). Ethanol is being used as a substitute for petrol in cars. Ethanol made in this way is produced from a crop that can be grown every year.

Flow diagram for ethanol production from grain



During the process a chemical reaction occurs in which sugars from the grain are converted to ethanol and carbon dioxide.

Why is only part of the sugar turned into ethanol?

- (A) Ethanol evaporates in cooking.
(B) Crushing destroys some of the sugar.
(C) Ethanol is not the only product of the process.
(D) Carbon dioxide and ethanol are formed by rearranging atoms.

- v) Why is the production of ethanol considered to be a biotechnology?
- (A) Separation techniques are used in the process.
 - (B) The process can be explained using a flow chart.
 - (C) Carbon dioxide is a waste product from the process.
 - (D) The process uses micro-organisms to produce a useful product.
- vi) What advantage does ethanol have over fossil fuels?
- (A) It is easy to make.
 - (B) It is easy to transport as a liquid.
 - (C) The raw material is a renewable resource.
 - (D) It does not put carbon dioxide into the atmosphere
- vii) Carbon dioxide dissolves in cold water but forms bubbles of gas when the water warms.

How will the carbon dioxide levels in the atmosphere and ocean change as the ocean warms?

	<i>Level of Carbon dioxide in atmosphere</i>	<i>Level of Carbon dioxide in ocean</i>
(A)	Fall	Fall
(B)	Fall	Rise
(C)	Rise	Rise
(D)	Rise	Fall

(Refer to stimulus booklet to answer the following questions)

- viii) Which greenhouse gas is least affected by human activities?
- (A) Methane
 - (B) Water vapour
 - (C) Nitrous oxide
 - (D) Carbon dioxide

- (ix) What is the purpose of carbon dioxide capture and storage (CCS)?
- (A) To stop carbon dioxide emissions going into the atmosphere
 - (B) To enable a more efficient coal-burning process to occur
 - (C) To slow the increase in atmospheric temperature
 - (D) To capture carbon dioxide for re-use
- (x) Methane is a gas that increases the greenhouse effect.
What type of human activity would need to be modified to reduce methane production?
- (A) The use of cars
 - (B) The burning of coal
 - (C) Pollution from factories
 - (D) Farming practices

2) **One Word Answers**

- i) The word equations below show two important processes which are part of the global carbon cycle.

<i>Process</i>	<i>Word Equation</i>
Photosynthesis	carbon dioxide + water \rightarrow glucose + oxygen + water
Respiration	glucose + oxygen \rightarrow carbon dioxide + water

Which process will tend to reduce the amount of carbon dioxide in the atmosphere?

(Refer to stimulus booklet to answer the following questions)

- ii) What was the atmospheric carbon dioxide level in 1995?
- iii) What was the increase in the concentration of atmospheric carbon dioxide between 1980 and 2000?
- iv) What is the average increase in surface temperature (in°C) caused by the presence of Earth's atmosphere?
- v) Rocks are one place where scientists think carbon dioxide may be stored. Name the other place where carbon dioxide can be stored.

3) Short Answer Questions

- i) In the future, the quality of our lives and the environment will depend on how society deals with problems such as climate change, natural events and how we obtain and use energy.

Evaluate an impact of an environmental problem. In your answer, show how science can help reduce the impact on society and the environment.

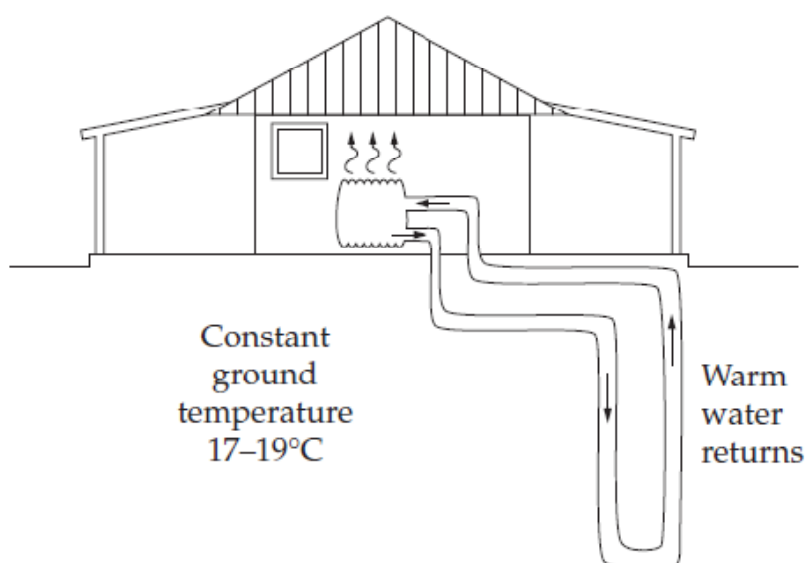
School Certificate 2006

1) Multiple Choice

- i) LEDs (light-emitting diodes) convert electrical energy directly into light. LEDs do not have 'bulbs' like light globes, but use a lens to focus the light. LEDs are efficient, give off little heat, and can be made of plastic.

What is one benefit to the environment of using LEDs?

- (A) Plastics are stronger than glass.
(B) LEDs have a greater range of colours.
(C) LEDs are made from renewable resources.
(D) Less heat will be released into the surroundings.
- ii) The diagram shows a method of using the heat energy of the earth as a way of heating houses. Water circulates through pipes which are buried in the ground. As the water circulates, it absorbs heat from the ground and releases it into the house. This is an example of an energy source that can maintain the sustainability of the environment.

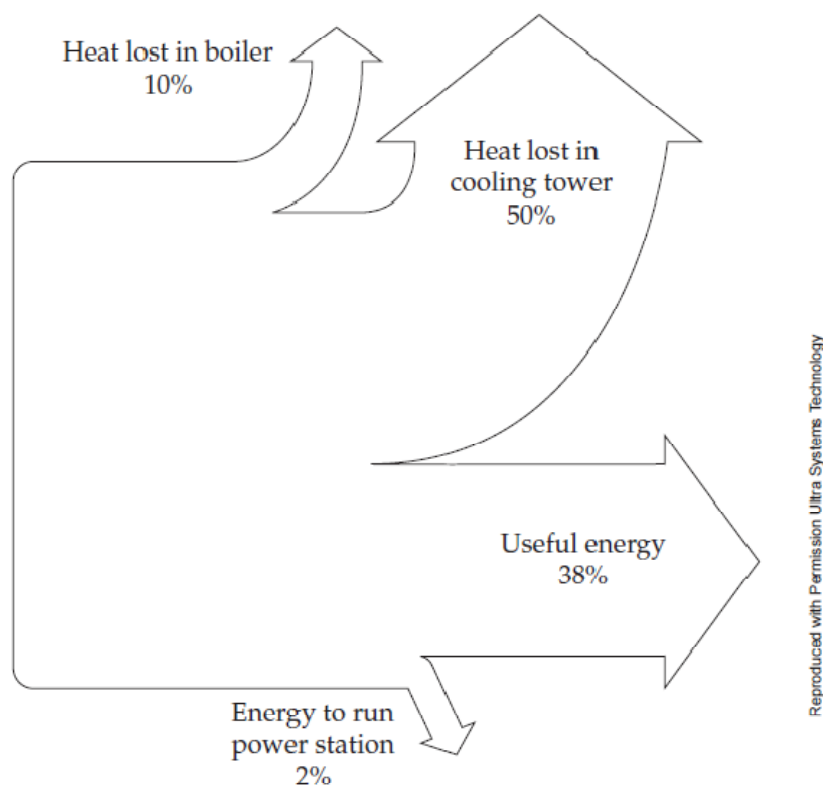


What needs to occur if this energy source is to be considered sustainable?

- (A) The energy source is reliable and low cost.
- (B) The energy is easy to collect and can be easily utilised.
- (C) The rate at which the energy is used is more than the rate at which it is replaced.
- (D) The rate at which the energy is used is less than the rate at which it is replaced.

iii)

The diagram shows the energy changes that occur when coal is burned in a power station.



What percentage of energy is lost as heat in this process?

- (A) 10%
- (B) 50%
- (C) 60%
- (D) 90%

1) Multiple Choice

- i) Which of the following energy sources contributes LEAST to the greenhouse effect?
- (A) Coal
(B) Natural gas
(C) Nuclear
(D) Petroleum
- ii) Some scientists believe that releasing too much carbon dioxide into the atmosphere changes the weather on Earth.
What could cause these weather changes?
- (A) Carbon dioxide traps energy in the atmosphere.
(B) Solid carbon dioxide (dry ice) falls as hailstones.
(C) Carbon dioxide uses up energy in the atmosphere.
(D) Carbon dioxide lets more energy escape from the atmosphere

2) Short Answer Questions

- i) Coal X and Coal Y are two different types of coal that can be burned in a power station to generate electricity. The table provides information collected when samples of Coal X and Coal Y were burned to heat the same volume of water.

	Coal X	Coal Y
<i>Mass of coal burned</i>	1000 g	1000 g
<i>Temperature of water before coal was burned</i>	20°C	20°C
<i>Temperature of water after coal was burned</i>	50°C	65°C
<i>Gaseous wastes from burning</i>	CO ₂ , H ₂ O and large amounts of SO ₂ and NO ₂	CO ₂ , H ₂ O and small amounts of SO ₂ and NO ₂
<i>Solid wastes (ash and soot) from burning</i>	200 g	100 g
<i>Cost per tonne</i>	\$85	\$100

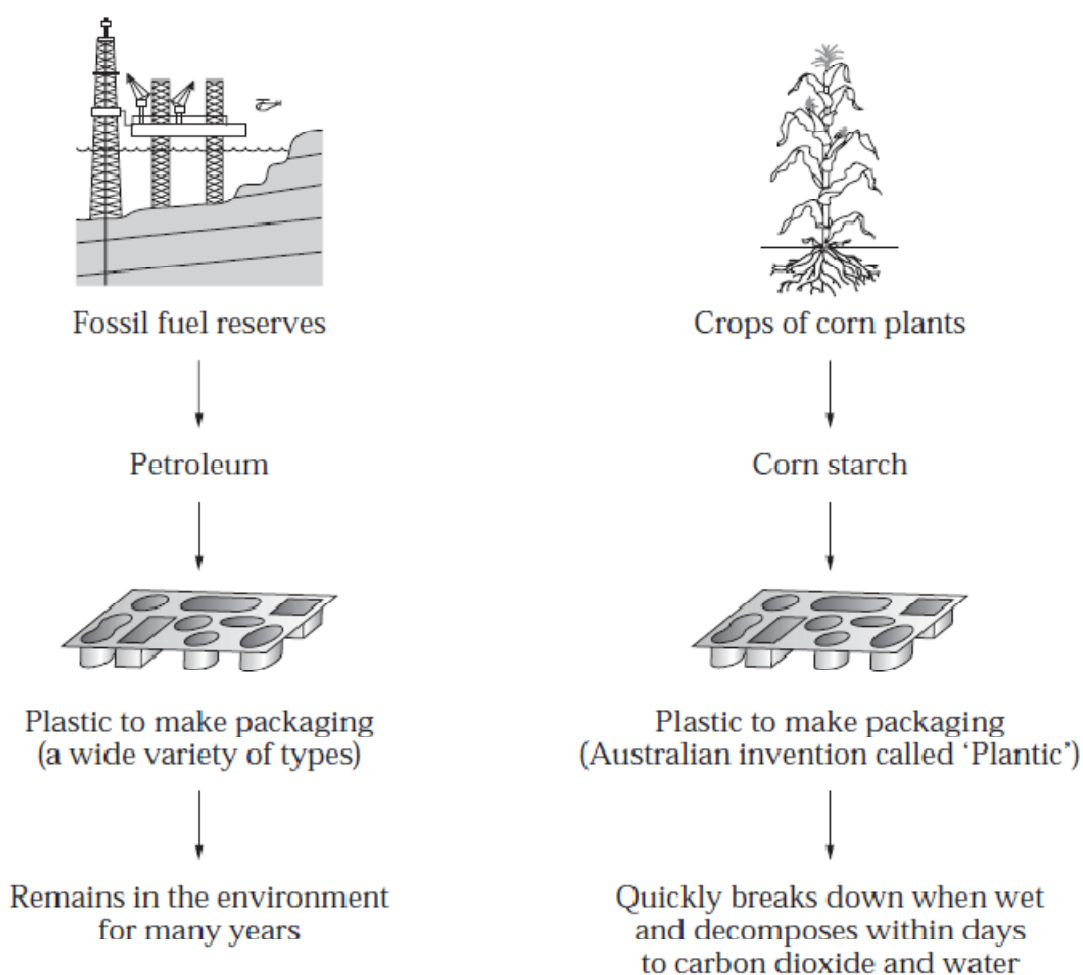
Recommend either Coal X or Coal Y for use in a power station. Justify your choice using information from the table. You may also include other relevant information in your answer.

1) Multiple Choice

- i) Which of the following releases large amounts of carbon dioxide into the atmosphere?
- (A) Evaporation of oceans
 - (B) Combustion of fossil fuels
 - (C) Generation of power by wind turbines
 - (D) Generation of power using nuclear energy

Use the following information to answer the next three questions.

The diagram shows two alternative ways to produce plastic used for packaging.



- ii) What is 'Plantic'?
- (A) A type of plant
 - (B) The plastic made from petroleum
 - (C) The plastic used for all packaging trays
 - (D) A plastic invented by Australian scientists

iii) Which substances can be used to make plastic packaging?

- (A) Corn starch and petroleum
- (B) Fossils and corn starch
- (C) Oil rigs and corn plants
- (D) Petroleum and crops

iv) What is one benefit of inventing 'Plantic'?

- (A) Plantic will increase the use of fossil fuels.
- (B) Plantic is made from a renewable resource.
- (C) Plantic can last in the environment for many years.
- (D) Plantic does not add any carbon dioxide to the atmosphere

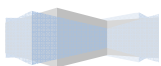
2) Short Answer Questions

i) A new power plant for generating electricity is to be built in a bushland area.

Identify TWO potential impacts on the environment of building this new power plant.

ii) In Australia, most electricity is generated either by burning coal or by water flowing through a hydro-electric power plant.

Discuss reasons that support the method of electricity generation you believe has LEAST impact on the environment.



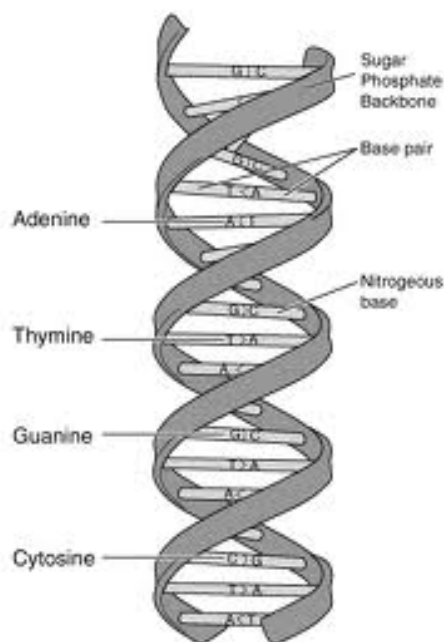
Chromosomes, Genes And DNA

Chromosomes are tiny thread-like structures in the nucleus of cells. Human cells contain 46 chromosomes that exist as 23 pairs. The X and Y chromosomes are called the sex chromosomes because they determine the sex of an individual.

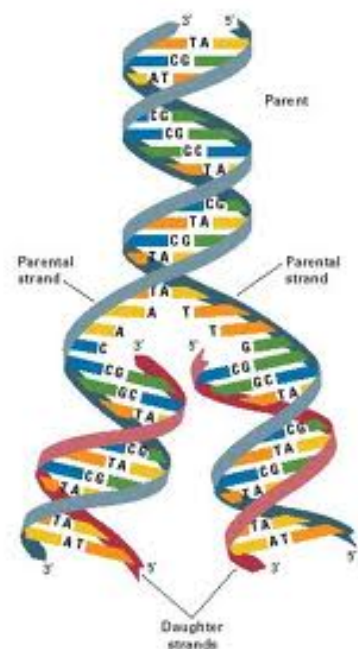
XX = female and XY = male.

Genes are located on chromosomes and carry the information that determines an individual's characteristics. Children inherit 23 chromosomes from each parent which means that they receive half of their genes from each parent and so resemble each of their parents in some ways. Environmental factors also have some effect in determining the characteristics of an individual.

Chromosomes are made of DNA (deoxyribonucleic acid) which has a double helix structure, that is, it looks like a twisted ladder. DNA contains two strands of sugars and phosphates joined along their length by pairs of bases. The base pairs are adenine-thymine (A-T) and cytosine-guanine (C-G).



Structure of DNA



DNA Replication

DNA Replication

Cells divide to produce new cells for growth, repair and reproduction. Before they divide, their DNA must be replicated (copied) exactly so that the new cells receive the correct DNA which means that normal growth, repair and reproduction will occur.

Mutations

A mutation is a change in a gene and it occurs when DNA is not replicated exactly. Some mutations are an advantage eg, a mutation in a wild variety of grape produced the Concord grape which is larger and sweeter than other grapes. Other mutations are a disadvantage eg, the disease cystic fibrosis comes from a gene mutation and it causes abnormal cell function that produces excess mucus in the lungs and digestive tract.

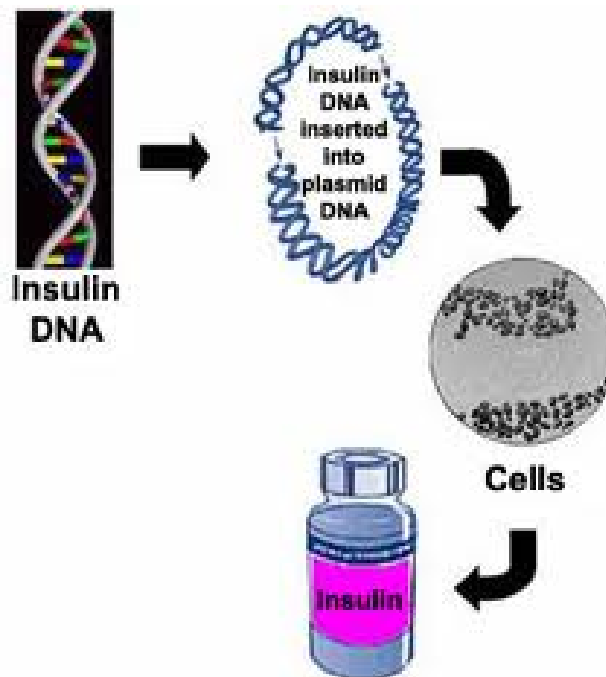
Biotechnology

Biotechnology is the use of living organisms to produce useful materials for medicine and industry. Some examples of biotechnology are using yeast to make alcohol, using bacteria to clean up oil spills, using bacteria to produce human insulin, cloning, stem cell therapy, DNA fingerprinting.

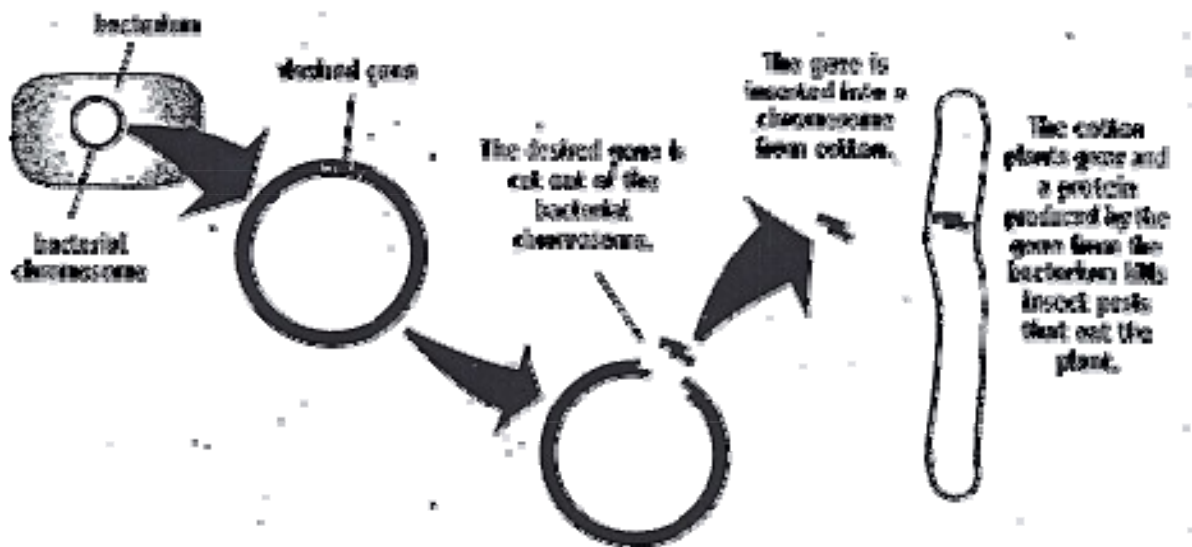
Genetic Engineering

Genetic engineering is a type of biotechnology that changes genes. It involves inserting genes from one species into the chromosomes of another species. The recipient of the inserted genes is called a transgenic organism.

One use of genetic engineering in medicine is the production of human insulin by bacteria. The gene for human insulin is inserted into bacteria and then the bacteria make human insulin. The insulin is collected and given to diabetics. The benefits are that it provides an unlimited supply of insulin and many diabetics are not allergic to it.



One use of genetic engineering in agriculture is the protection of cotton plants from caterpillars. The Bt bacterium contains a gene that produces a protein that kills caterpillars. This gene is inserted into the cells of cotton plants so that the plants make the protein. When the caterpillar eats the plant, it takes in the protein and dies. Two benefits are that farmers use less pesticide sprays and they get a higher yield of cotton.



Genetically Modified Crops

Genetic engineering is used in agriculture to produce genetically modified crops (GM crops).

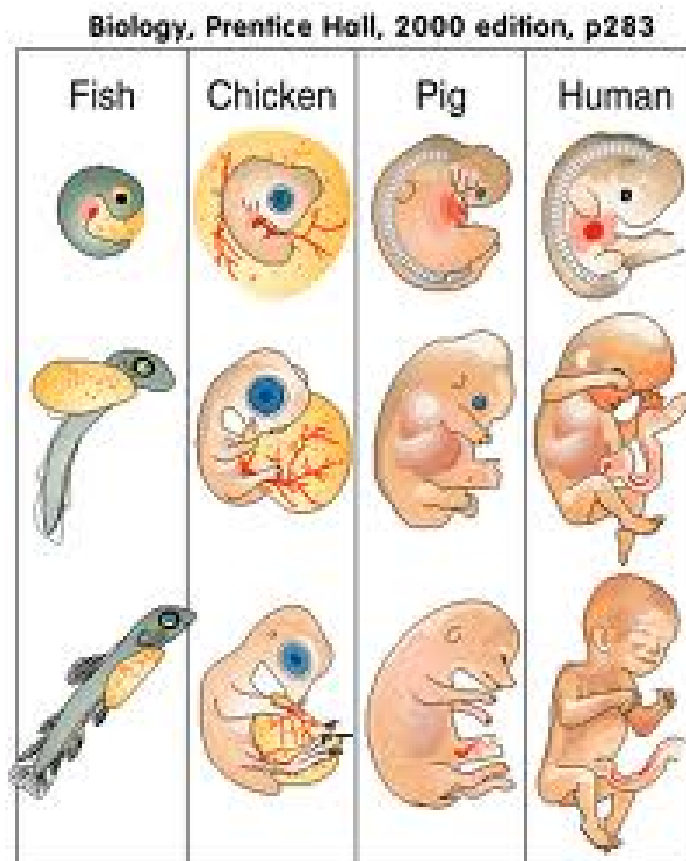
GM crops have been inserted with a gene that makes them superior to conventional crops, such as crops that are higher quality, disease resistant, grow in poor soils, have a higher yield, have a shorter growing period. All of these benefits produce a larger, better quality crop harvest which results in a higher profit for farmers.

The use of GM crops however is causing concern because of their unknown long term impact on ecosystems. For example, crops with inbuilt pesticides kill insect pests that eat them but they might also kill insects that are not pests. As a result, this would threaten damage to all organisms in the food web.

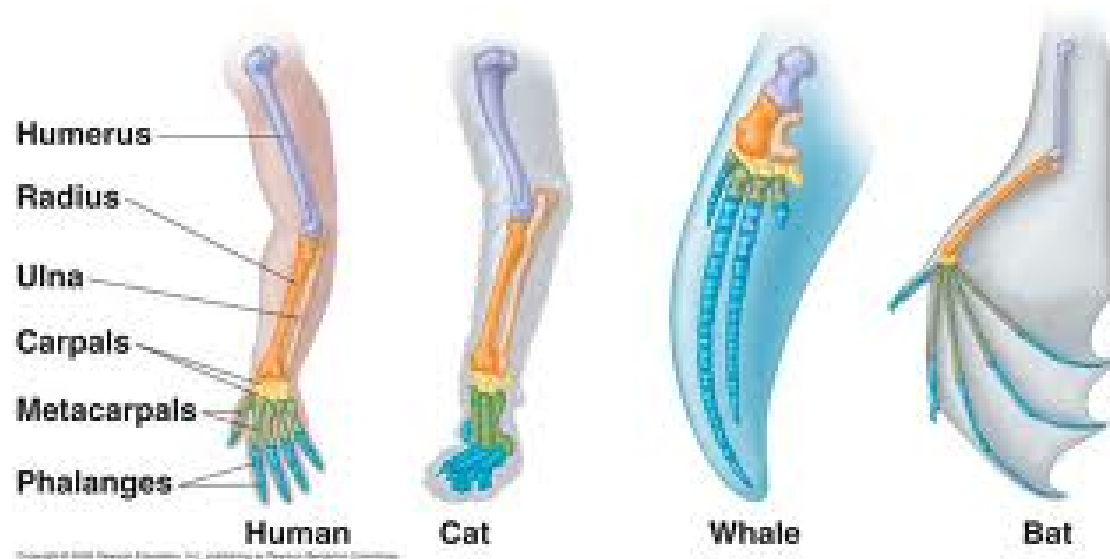
Evolution

Evolution is the process of gradual change in a population of organisms that results in new species. A species is defined as a population of organisms that can interbreed. Some evidence for evolution is as follows:

- ☺ FOSSILS - Fossils show that the earliest life forms were simple organisms living in water and that since then organisms have become more complex and have moved onto land. Some fossils show links between groups of organisms. For example, Archaeopteryx is an extinct vertebrate that has features of both reptiles and birds and is thought to show a transition from reptiles to birds.
- ☺ SIMILAR EMBRYOS – The very young embryos of a number of vertebrates such as fish, salamander, turtle, chicken, pig, cow, rabbit and human look very similar and some scientists have concluded that the vertebrates have evolved from a common ancestor.



- ☺ SIMILAR FORELIMBS – In many vertebrates the forelimbs such as forearm, wing, flipper and foreleg all show a similar arrangement of bones. Some scientists have concluded that vertebrates have evolved from a common ancestor.



Natural Selection And Evolution

Natural selection, also called survival of the fittest, is the process in which living things that are best adapted to their environment survive.

Darwin's theory of evolution is as follows:

- ☺ Far more offspring are produced than survive and reproduce.
- ☺ These offspring have a range of characteristics.
- ☺ Offspring with particular characteristics are better adapted to their environment and so survive while other offspring perish. This is called natural selection or survival of the fittest.
- ☺ The surviving organisms reproduce and pass on the favourable characteristics to their offspring. Over time the population changes so that most organisms have the favourable characteristics.

Darwin's theory of evolution by natural selection can be used to account for the change in populations. The peppered moth population of north England is one example. Peppered moths are born either pale coloured or nearly black. In 1850, when scientists first began to study them, there were few factories and very little pollution. The countryside was fresh and clean and the pale coloured moths were well camouflaged when they rested on light coloured tree trunks. The black moths were easily seen and were quickly eaten by birds. The pale coloured moths were much better suited to their environment. They survived and reproduce and so were much more common than the black moths. In the years since 1850, more and more factories were built in northern England and the soot from the factory smokestacks gradually blackened the light coloured tree trunks. The change in the environment meant that the black moths were well camouflaged and birds ate the pale coloured moths instead. The black moths survived and reproduced and became much more common than the pale coloured moths. Strong anti-pollution laws over the past twenty years have reduced the amount of smoke coming from factories resulting in the tree trunks becoming lighter in colour. The pale coloured moths are once again well camouflaged and more black moths are being eaten by birds.

Study Questions

1. What are chromosomes and where are they found?
2. Where are genes found and what do they do?
3. Where is DNA found?
4. What name is given to the structure of DNA?
5. Why do cells divide?
6. Why must DNA be replicated exactly before a cell divides?
7. Why do ova and sperm contain 23 chromosomes instead of 46 chromosomes?
8. What is a mutation?
9. Describe one example of an advantageous mutation and one example of a disadvantageous mutation.
10. What is biotechnology?
11. What is genetic engineering?
12. Describe one use of genetic engineering in
 - a) medicine
 - b) industry
13. Discuss the use of GM crops.
12. What is evolution?
13. Describe one other piece of evidence in support of evolution.
14. Using the peppered moth, Darwin's finches or another organism of your choice, explain the process of natural selection.

Glossary

DNA, double helix, chromosome, gene, characteristic, replication, mutation, biotechnology, evolution, natural selection

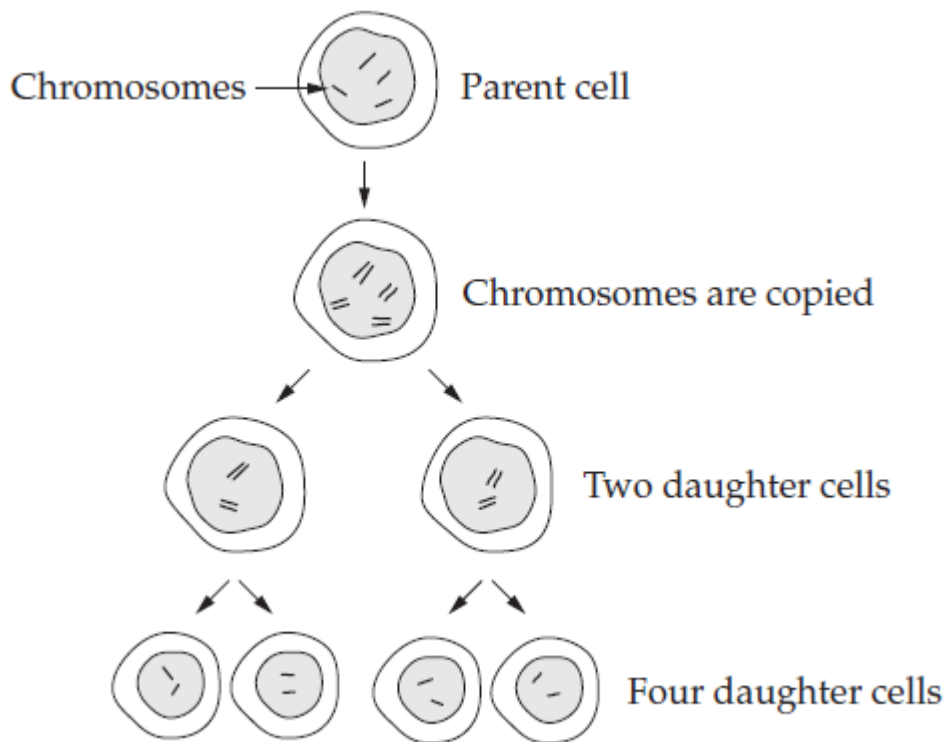
School Certificate 2010

1) Multiple Choice

- i) Which of the following is an example of a biotechnology?
- (A) Using bacteria to produce medicines
 - (B) Using a microwave oven to cook food
 - (C) Using a fossil to estimate the age of a rock
 - (D) Using a telescope to look for life on other planets

Use the following diagram to answer the next two questions.

Human cells usually contain 46 chromosomes. During cell division genetic information is passed from parent cell to daughter cell. The diagram models one type of cell division.



ii) In humans this type of cell division results in

- (A) cells that contain 46 chromosomes.
- (B) cells that contain 23 chromosomes.
- (C) two daughter cells that are identical to the parent cell.
- (D) four daughter cells that are identical to the parent cell.

iii) Which cells can be produced from this type of cell division?

- (A) Bone
- (B) Nerve
- (C) Sex
- (D) Skin

(Refer to stimulus booklet to answer the following questions)

- iv) What is the effect of the telomerase gene?
- (A) It stops the cell from dividing.
 - (B) It causes the telomeres to be rebuilt.
 - (C) It prevents the chromosomes from replicating.
 - (D) It reduces the risk of cells becoming cancerous.
- v) In 2005, what was the proportion of 69-year-old males with cancer in the population?
- (A) 1500
 - (B) 1500 per 100 000
 - (C) 2000
 - (D) 2000 per 100 000

2) *One Word Answers*

- i) What is the name of the structure on which information is transferred as DNA when cells reproduce themselves?

School Certificate 2009

1) **Multiple Choice**

- i) The diagram shows a DNA molecule.

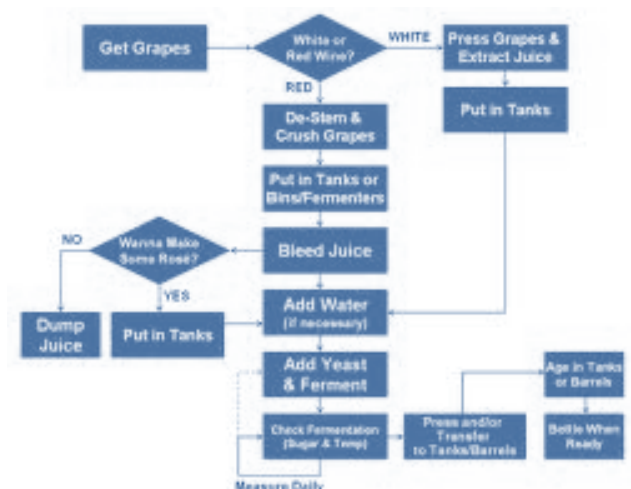


What is the name of the section labelled *P* on the DNA molecule?

- (A) Base
- (B) Chromosome
- (C) Gene
- (D) Nucleus

(Use the following diagram to answer the next three questions)

The process of making wine is outlined in the flowchart.



(Note: this is the not the one used in the SC as its still awaiting copyright)

- ii) Which wines are fermented completely before bottling?
- (A) Red wine and dry white wine
 - (B) Red wine and sweet white wine
 - (C) Dry white wine and sweet white wine
 - (D) Dry white wine and sparkling white wine
- iii) What is an advantage of presenting information in a flowchart?
- (A) It shows trends in data.
 - (B) It shows how much of each product is made.
 - (C) It shows the sequence of steps in the process.
 - (D) It shows the length of time involved in each step.
- iv) Why is fermentation an example of biotechnology?
- (A) The products can be consumed.
 - (B) Grape vines are a renewable resource.
 - (C) Living things are used in this process.
 - (D) Living things are not harmed in this process.
- v) Which two scientists are given credit for describing the structure of DNA?
- (A) Darwin and Wallace
 - (B) Fleming and Florey
 - (C) Newton and Mendel
 - (D) Watson and Crick

vi) What is an advantage of DNA mutating?

- (A) DNA is altered.
- (B) Mutations cause deformities.
- (C) Mutations give rise to variation.
- (D) DNA mutations are essential for transportation of materials.

vii) When cells divide to replace dead skin cells the DNA is replicated exactly.

What advantage does this give the new cells?

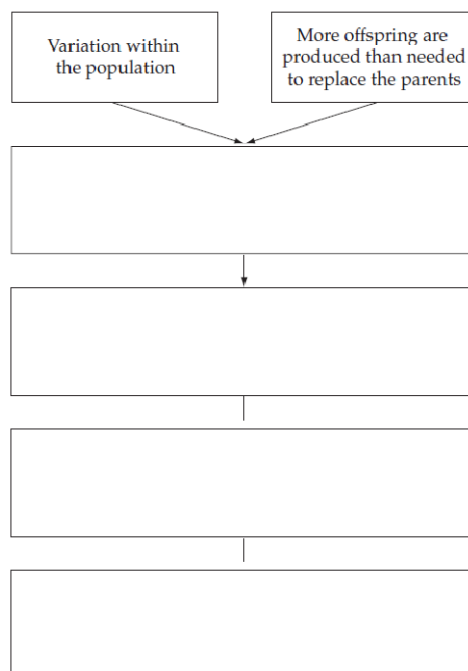
- (A) They will be more resistant to ultraviolet light.
- (B) They will last longer than the ones they replace.
- (C) They will be stronger than the ones they replace.
- (D) They will perform the same functions as the ones they replace

2) **One Word Answers**

i) What name do we give to any type of disease that can be passed from one person to another person?

3) **Short Answer Questions**

i) Complete the flowchart to summarise the process of natural selection and its effect on a species. Use as many boxes as you require.



- ii) Name a scientific theory and explain how a specific piece of evidence supports this theory.

School Certificate 2008

1) **Multiple Choice**

- i) Where is DNA found in the cell?
- (A) In the genes
 - (B) In the nucleus
 - (C) In the membrane
 - (D) In the cytoplasm
- ii) What happens to DNA as a result of a mutation?
- (A) It unwinds.
 - (B) It splits in two.
 - (C) It replicates exactly.
 - (D) It is not identical to the original.
- iii) Sheep frequently give birth to twins. Identical twins grow up to be different sizes when adults.
What is the main cause of this difference?
- (A) Environmental factors
 - (B) Genetic differences between the twins
 - (C) A combination of genetic and environmental factors
 - (D) Nothing to do with genetic or environmental factors
- iv) The diagram shows the differences in beak shape among different finch species

Which process caused the development of these species?

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- (A) Asexual reproduction
- (B) Ecological cycles
- (C) Migration
- (D) Natural selection

2) **One word answers**

(Refer to stimulus booklet to answer the question)

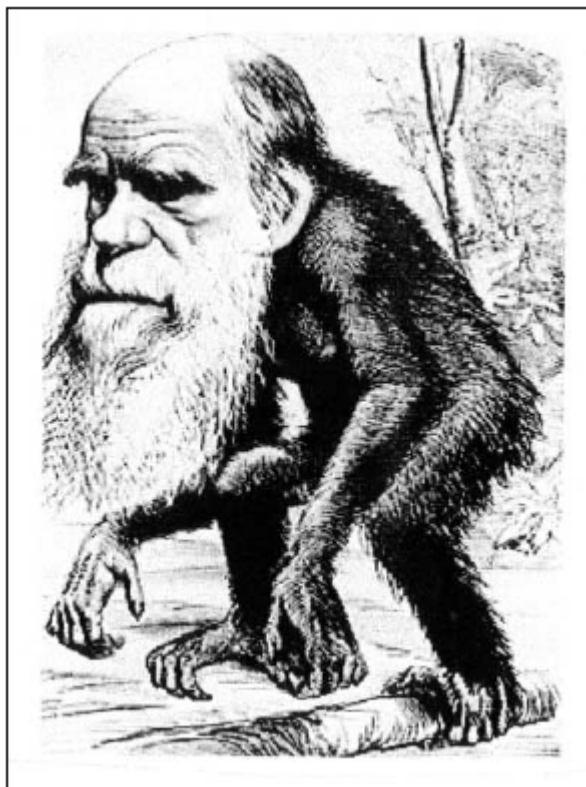
- i) Name the molecule that contains genetic material as shown in Source D.

School Certificate 2007

1) Multiple Choice

- i) When Charles Darwin published his theory in 1858, many people tried to discredit him.

The following drawing of Charles Darwin appeared in a magazine, '*The Hornet*', on 22 March 1871.



Why was Darwin represented in this way?

- (A) Darwin's theory was considered primitive.
- (B) Darwin's theory was about humans descending from apes.
- (C) Darwin's theory challenged religious and societal beliefs of his time.
- (D) Darwin's theory was about an animal that was half ape and half human.

- ii) How does Darwin's theory contribute to scientific understanding?
- (A) It provides an explanation of the cell theory.
 - (B) It provides an explanation of Mendelian genetics.
 - (C) It provides a process by which evolution can occur.
 - (D) It provides a process for inheriting acquired characteristics.
- iii) When cells reproduce, what does the transferred DNA contain?
- (A) Chromosomes
 - (B) Genes
 - (C) Nucleii
 - (D) Proteins
- iv) The student wanted to include data on her great grandmother's eye colour in her investigation. Her mother told her that her great grandmother's eye colour was brown. Photographs of her great grandmother and a diary description written by her great grandfather both confirmed the information provided by her mother.
- Which of the following judgements can be made of the data she collected?
- (A) It was reliable because she had obtained the information from her family.
 - (B) It was reliable because she compared it with observations or information from a number of sources.
 - (C) It was not accurate because she had to compare it with information from secondary sources.
 - (D) It was less accurate because she had to compare it with observations or information from a number of sources.
- v) What is the best explanation for the increase in proportion of narrow headed snakes?
- (A) Snakes with broad heads were favoured by natural selection.
 - (B) Snakes with broad heads were not resistant to the cane toad poison.
 - (C) Snakes with narrow heads developed a gene that made them resistant to the poison.
 - (D) Snakes with narrow heads ate smaller cane toads with less poison, survived and reproduced

2) Short Answer Questions

i)

Some milestones in biology

<i>Year</i>	<i>Code</i>	<i>Event</i>
1861	A	Louis Pasteur defined the role of micro-organisms.
1866	B	Mendel determined the principles of genetics, using pea plants.
1928	C	Alexander Fleming discovered penicillin.
1953	D	Watson and Crick determined the structure of DNA.
1997	E	Dolly, the first mammal clone, was produced.

Use the codes provided to construct a timeline of these events on the line below. Two dates have been plotted for you.



School Certificate 2006

1) Multiple Choice

- i) What is a gene?
- (A) A chromosome
 - (B) A section of DNA
 - (C) An inherited disease
 - (D) A compound found in all cells
- ii) One type of cell division in multicellular organisms results in new cells that have half the original number of chromosomes. In which process is this type of division important?
- (A) Coordination
 - (B) Growth
 - (C) Repair
 - (D) Reproduction]

- iii) The theory of evolution states that all living things developed from simpler organisms.

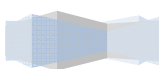
Why is this statement known as a theory?

- (A) There is no evidence for the idea.
 - (B) Scientists cannot agree about the idea.
 - (C) The idea is not open to doubt or argument.
 - (D) Scientists may modify the idea as they gather more evidence
- iv) Why can a mutation be an advantage for populations of living things?
- (A) It always makes organisms more disease-resistant.
 - (B) It causes new structures to develop in individuals.
 - (C) It creates variations in the characteristics of organisms.
 - (D) It makes cells in an individual work and divide faster.
- v) Which process is an example of a beneficial use of biotechnology?
- (A) Recycling paper and aluminium cans
 - (B) Measuring nutrients in soil samples from farms
 - (C) Developing better types of paint to resist salt air
 - (D) Commercial production of yoghurt by adding bacteria to milk

2) **Short Answer Questions**

- i) You have been asked to prepare a talk for Year 9 students on the features and functions of DNA.

Outline the information you would present in your talk. In your outline, identify ONE diagram you would include and give a reason for your choice. (It is NOT necessary to draw the diagram.)



School Certificate 2005

1) **Multiple Choice**

- i) What term describes what happens when cells in an organism are functioning abnormally?

(A) Death
(B) Disease
(C) Evolution
(D) Natural selection

- ii) Three scientists were awarded the Nobel prize for developing a model of DNA.

What is the name of one of these scientists?

(A) Darwin
(B) Mendel
(C) Wallace
(D) Watson

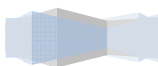
2) **One word Answers**

- i) What specific term describes the process in which DNA copies itself exactly?
- ii) Some diseases are caused by organisms such as bacteria and fungi. These can be transmitted in various ways through the environment.

What term do biologists use to describe this group of diseases?

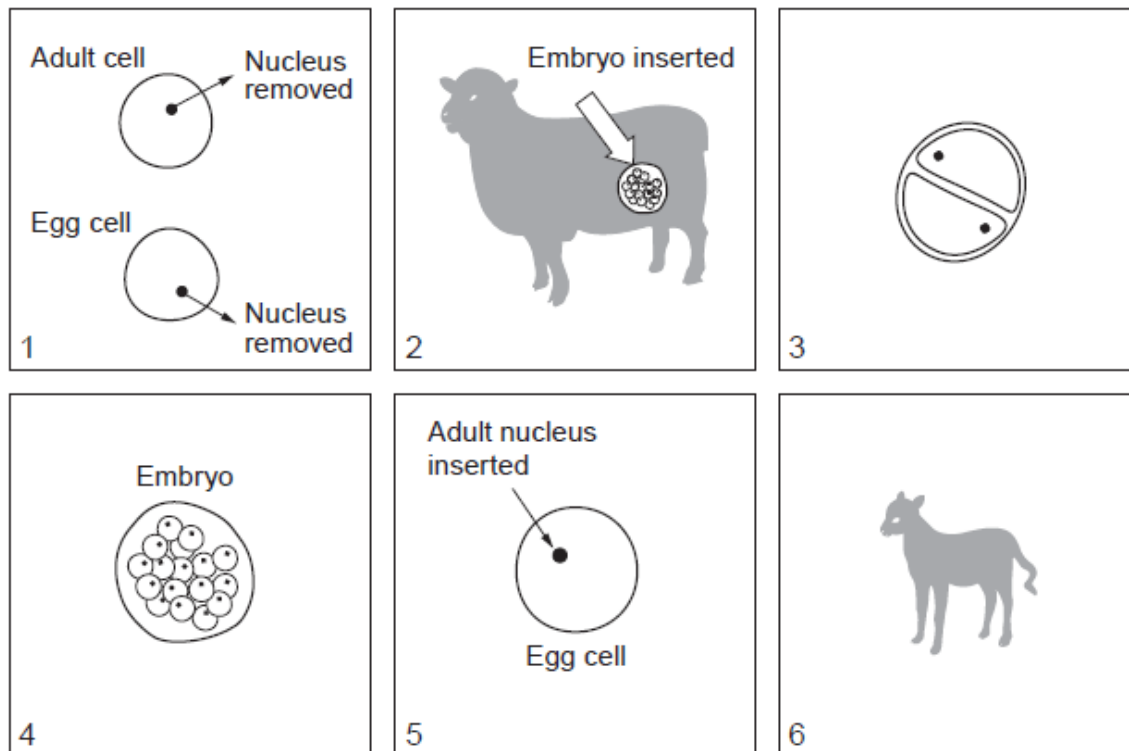
3) **Short answer Questions**

- i) Name an example of a technology or invention developed by scientists.
- ii) Explain how an advance in technology has increased scientific knowledge.



1) **Multiple Choice**

- i) The six diagrams show a reproductive process. They are not in the correct order.



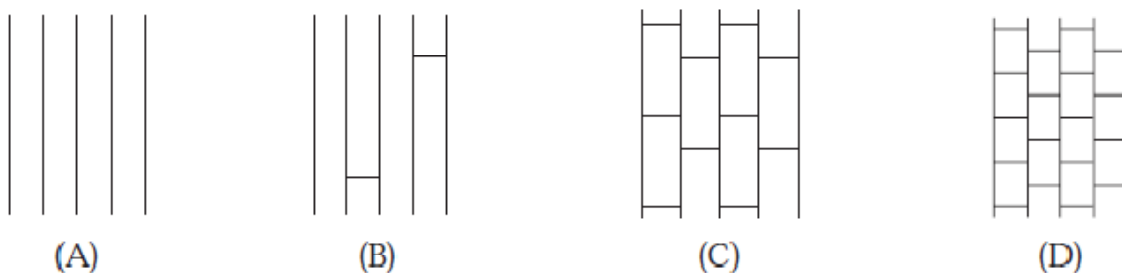
Which choice shows the correct sequence for this process?

- (A) 1 → 2 → 4 → 5 → 3 → 6
- (B) 1 → 3 → 2 → 5 → 4 → 6
- (C) 1 → 2 → 4 → 3 → 5 → 6
- (D) 1 → 5 → 3 → 4 → 2 → 6

The table shows some properties of three types of polymers

<i>Polymer</i>	<i>Properties</i>
Thermoplastic	<ul style="list-style-type: none"> softens when heated small amounts of linking between strands of polymer permanently changes shape when stretched
Elastomer	<ul style="list-style-type: none"> returns quickly to original shape after stretching moderate amounts of linking between strands of polymer
Thermosetting	<ul style="list-style-type: none"> large amounts of linking between strands of polymer does not soften when heated

ii) Which diagram best represents the structure of a thermoplastic polymer?



iii) Four polymer samples were tested in a laboratory. Which sample is made from an elastomer?

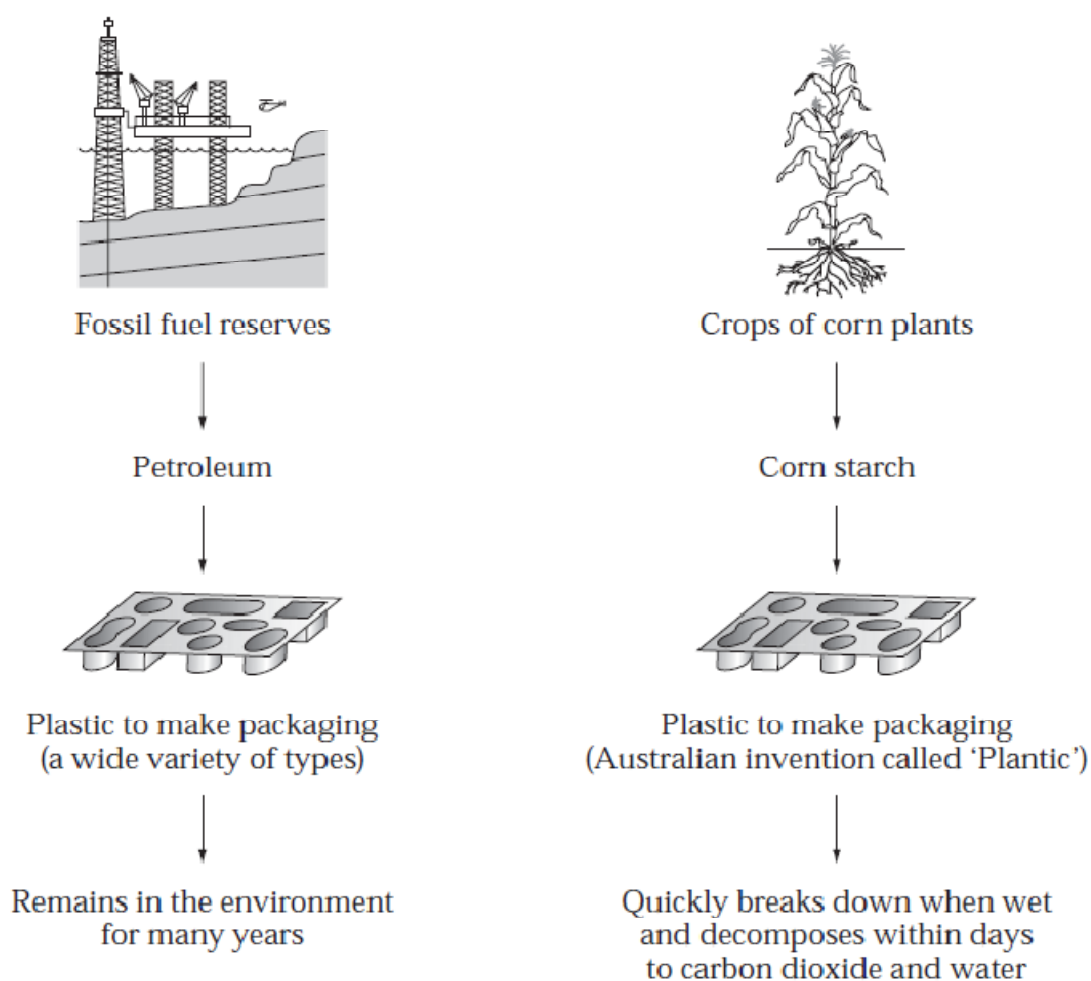
	<i>Placed in Hot Water</i>	<i>After stretching</i>
(A)	No change	Broken
(B)	Bends	Becomes longer
(C)	No change	Becomes longer
(D)	No change	No change

iv) What would be a suitable use for thermosetting polymers?

- (A) Garden hose
- (B) Mouthguard
- (C) Saucepan handle
- (D) Shrink-wrap packaging

Use the following information to answer the next three questions

The diagram shows two alternative ways to produce plastic used for packaging.



v) What is 'Plantic'?

- (A) A type of plant
- (B) The plastic made from petroleum
- (C) The plastic used for all packaging trays
- (D) A plastic invented by Australian scientists

vi) Which substances can be used to make plastic packaging?

- (A) Corn starch and petroleum
- (B) Fossils and corn starch
- (C) Oil rigs and corn plants
- (D) Petroleum and crops

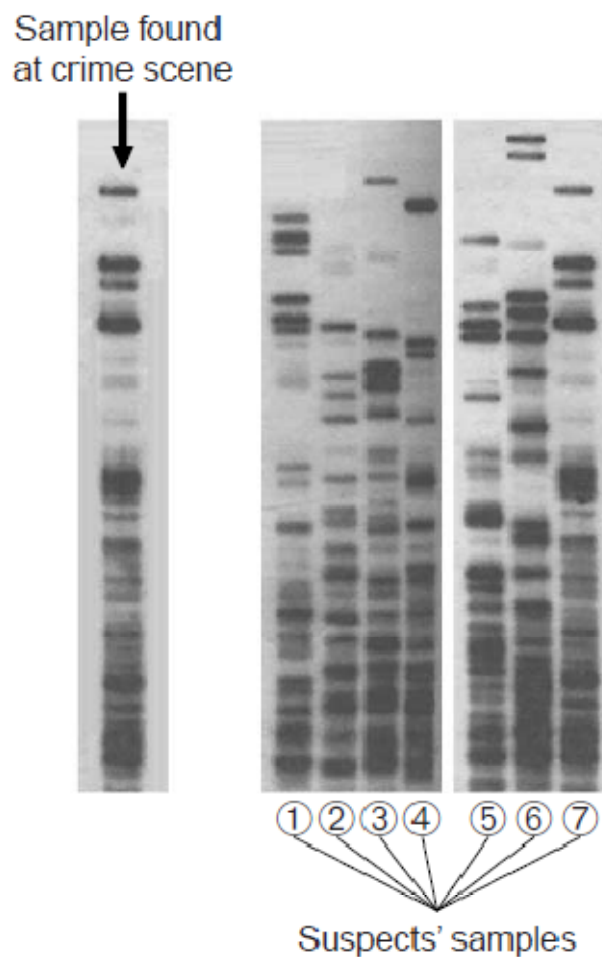
vii) What is one benefit of inventing 'Plantic'?

- (A) Plantic will increase the use of fossil fuels.
- (B) Plantic is made from a renewable resource.
- (C) Plantic can last in the environment for many years.
- (D) Plantic does not add any carbon dioxide to the atmosphere.

2) **One word Answers**

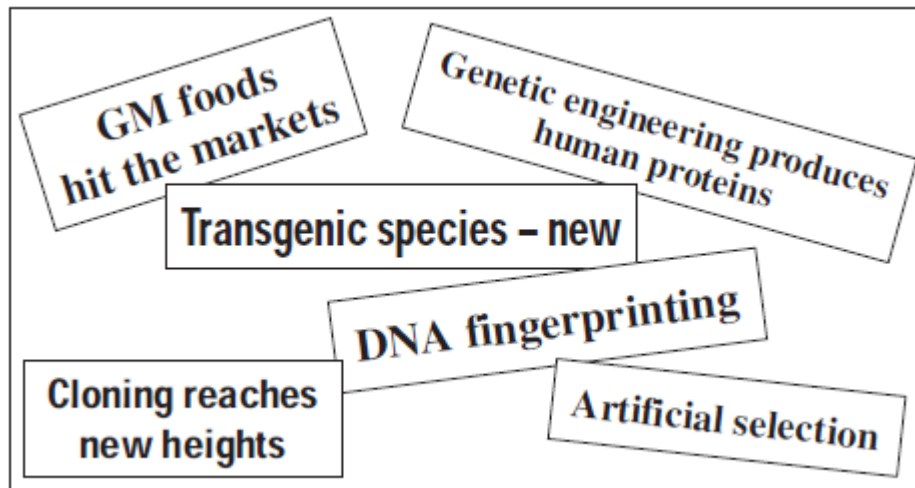
- i) Name the thread-like structures containing DNA that are found in the nucleus of most cells.
- ii) DNA fingerprinting can be used to identify a suspect in a crime.

The diagram shows a DNA pattern found at a crime scene. Which suspect's sample matches the sample found at the crime scene?



3) **Short Answer Questions**

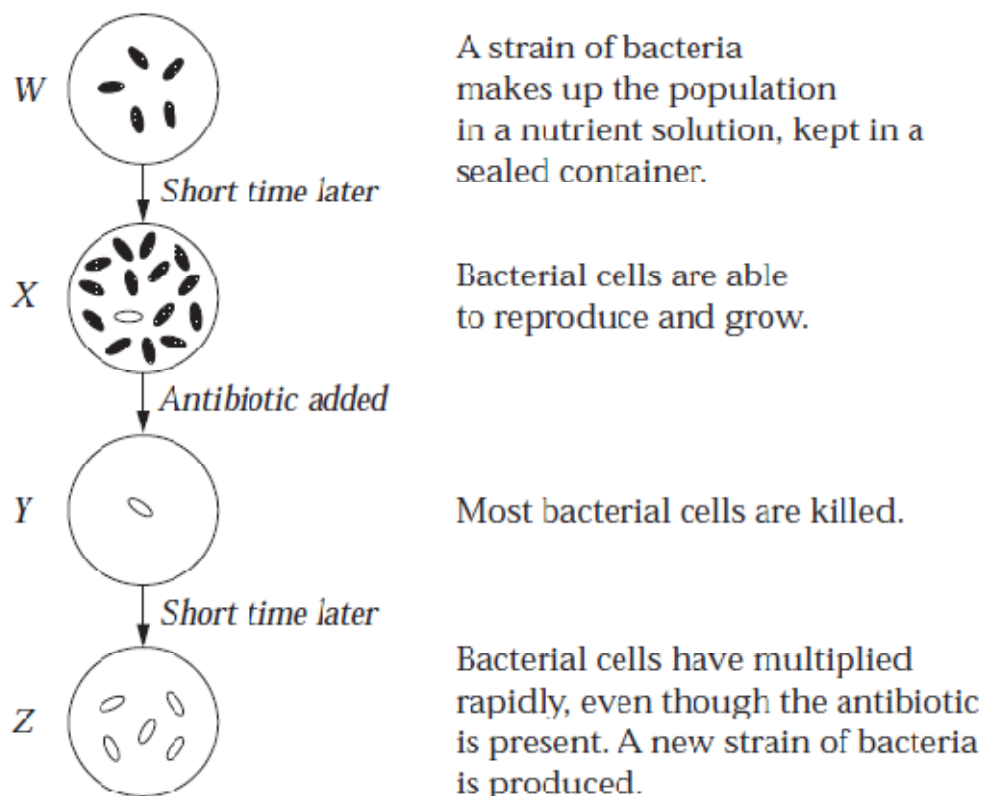
- i) The diagram shows some newspaper headlines related to biotechnology.



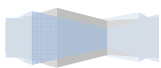
Select ONE of these biotechnologies, or ONE you have studied in class.

Discuss TWO impacts of its use on society.

The diagram shows natural selection in a bacterial population.



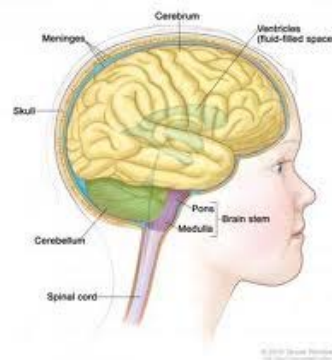
- ii) Using the information in the diagram, explain how the process of natural selection has occurred.
- iii) DNA mutations can occur when an organism reproduces. Explain why such mutations may be an advantage for its survival.



Nervous System

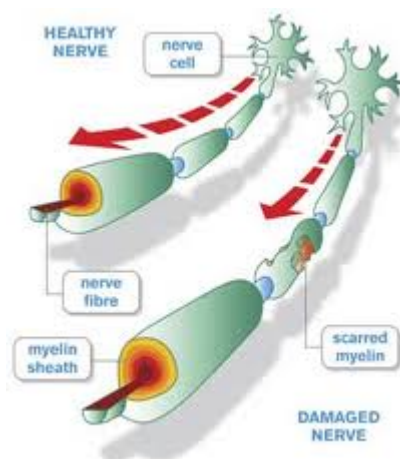
The nervous system consists of the brain and spinal cord, called the Central Nervous System (CNS) and nerves connecting the CNS to all parts of the body. It coordinates activities in the body by allowing it to receive stimuli and respond to them. It works as follows:

- ☺ receptors receive stimuli eg, ears hear sounds, eyes see things, nose smells odours, skin feels heat and pain;
- ☺ the stimuli are changed into electrical impulses and sent along sensory nerves to the brain;
- ☺ the brain sends electrical stimuli along motor nerves to the muscles;
- ☺ the muscles produce a response to the original stimulus eg, the person runs from danger, blocks their ears from a loud sound, covers their eyes from a bright light;



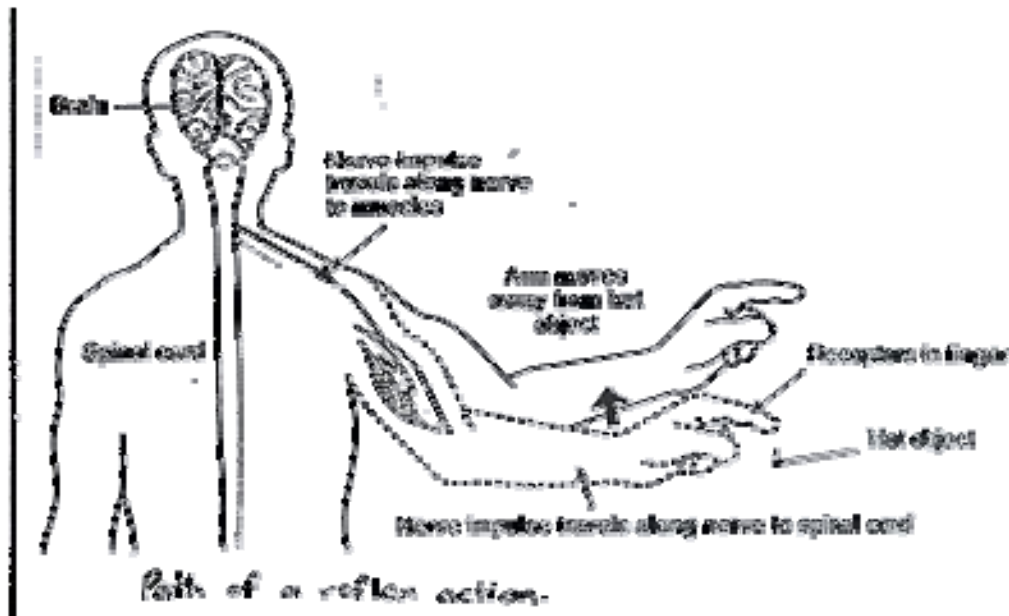
A Disease Of The Nervous System

Multiple sclerosis is a disease of the brain and spinal cord in which the myelin sheath around nerves breaks down. As a result, nerve impulses cannot travel properly between the brain and the rest of the body. There are many symptoms of this disease depending on which nerves are damaged. These symptoms include sensory loss eg. loss of vision, loss of feeling, and motor loss eg. loss of movement, weakness in muscles.



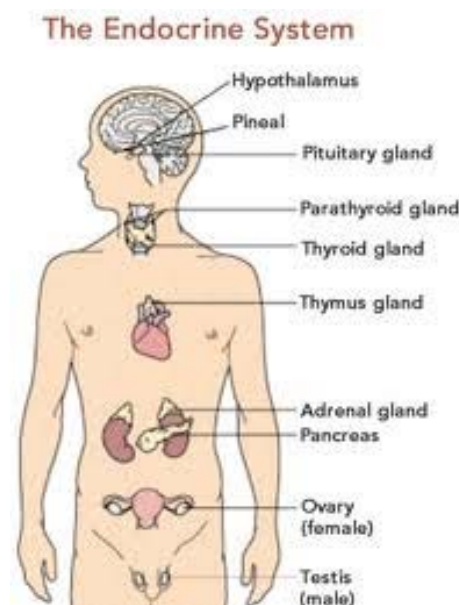
Reflex Actions

A reflex action is a very fast response to a stimulus. The electrical impulse travels along the sensory nerve and then passes directly to the motor nerve rather than to the brain. It is usually a response to danger eg, when you touch a hot object you pull your hand away very quickly without thinking.

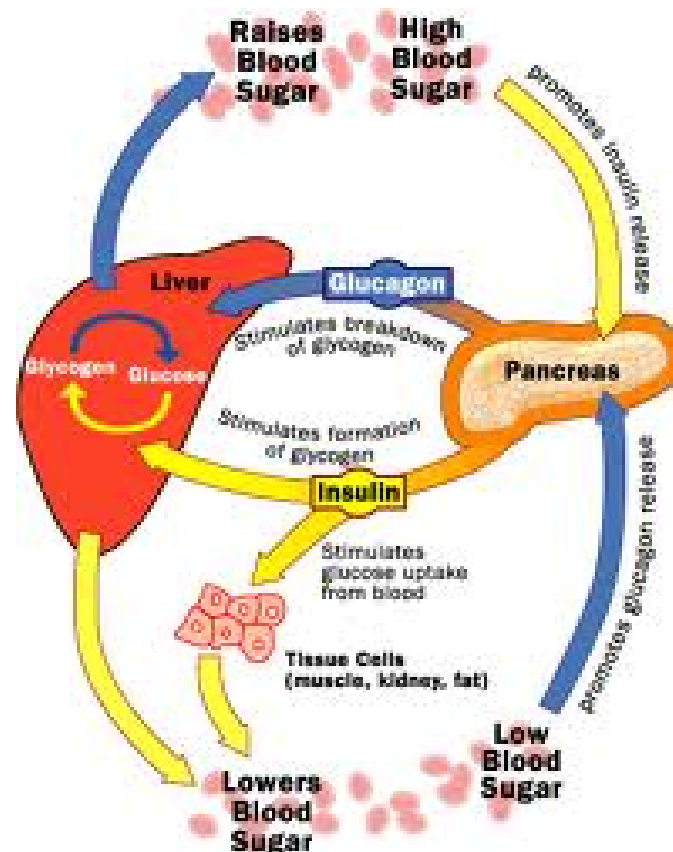
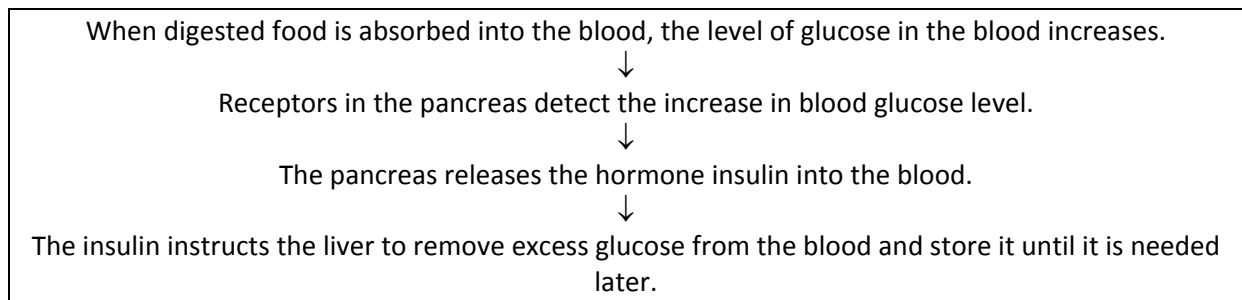


Endocrine System

The endocrine system controls activities in the body using hormones produced in glands. The hormones are carried by the blood to target organs where they are used to control growth, sexual development, body heat and levels of chemicals in the body such as glucose, water and salts. The endocrine system works as follows.



One hormone is insulin. It works as follows.



Diabetes Mellitus

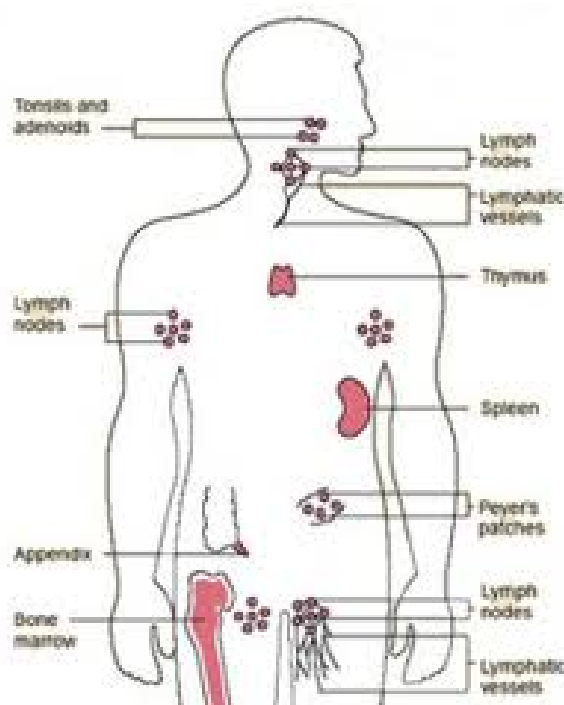
The disease Diabetes mellitus, also called sugar diabetes, is caused when the pancreas does not produce enough insulin. This results in a build up of glucose in the blood and urine. The high levels of glucose in the blood cause blood vessel walls to thicken which means that blood flow is blocked. This leads to problems with the eyes, kidneys, legs and hearts.

The Fright Response – Fight Or Flight Reaction

The fright response involves both the nervous system and the endocrine system. This response can be initiated by shock, anger, passion, anxiety or stress. The nervous system detects fright stimuli, which are transmitted to the brain. The brain stimulates the pituitary gland to release hormones into the bloodstream. In particular, the adrenal glands above the kidneys react and release the hormone adrenalin into the blood. As a result, the pupils dilate, the skin becomes pale, the sense organs become highly sensitive, the heart beats faster, glucose is released into the blood, blood pressure increases and the lungs work more effectively. The body is now ready for action, either for fight or for flight.

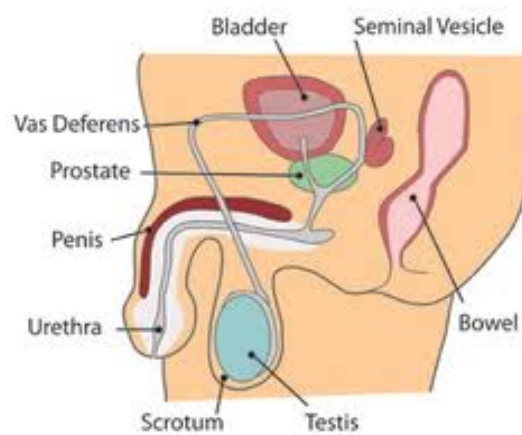
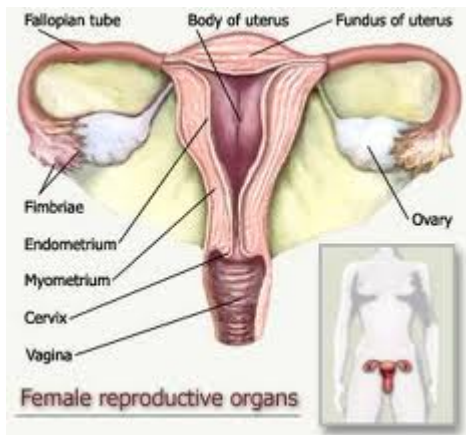
Immune System

The immune system protects the body against infectious diseases. When microorganisms such as bacteria and viruses invade the body, the immune system recognises them and produces antibodies that attack and destroy them.



Human Reproduction

In females, ova (eggs) are produced in the ovaries and travel along the oviducts. In males, sperm are produced in the testes and travel along the vas deferens to the seminal gland where they mix with seminal fluid to form semen. During intercourse the penis is inserted into the vagina and semen is released. The sperm travel up the vagina into the uterus and on to the oviducts. If there is an ovum in one of the oviducts, one sperm will fertilise it and a new cell called a zygote is formed. The cell divides into many cells to become an embryo that travels along the oviduct to the uterus. There it spends the next nine months developing into a baby.

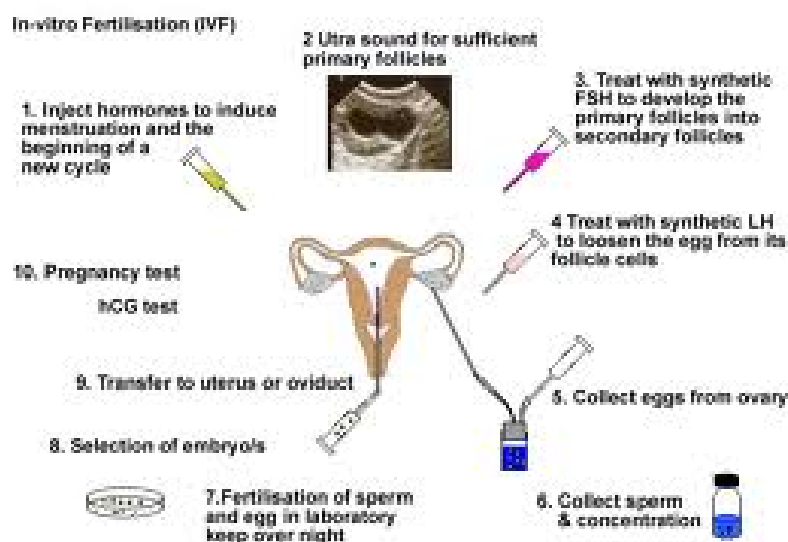


In Vitro Fertilisation

In vitro fertilisation (IVF) is a biotechnology that is used when pregnancy cannot occur naturally. Ova are collected from the female and sperm from the male and they are mixed in a lab. After fertilisation occurs, one or several embryos are implanted into the uterus of the female for pregnancy to proceed.

Often fertilisation does not occur successfully because of blocked fallopian tubes, low sperm count and low sperm motility. IVF overcomes these problems to allow pregnancy to occur. This means that couples who could not conceive children naturally are able to realise their dream and have one child or several children.

However, medications, injections and other procedures can cause stress, discomfort and other side effects such as fatigue, dizziness, nausea and headache. These side-effects can cause great discomfort for the mother, sometimes leading to financial and emotional stress for the couple.



Revision Questions

1. Identify the parts of the nervous system.
2. Describe the structure and function of the nervous system in the body.
3. Describe the pathway of a voluntary response.
4. Describe one example of a reflex action.
5. Compare the pathway of a reflex action (involuntary response) to the pathway of a voluntary response.
6. Identify one non-infectious disease of the nervous system and describe its effects on the body.
7. Describe the structure and function of the endocrine system in the body.
8. Identify one non-infectious disease of the endocrine system and describe its effects on the body.
9. Identify one hormone and describe its role in the body.
10. Explain how the nervous system and the endocrine system work together to produce the “flight or fight” reaction.
11. Describe the role of the immune system.
12. Using an example, describe the response of the immune system to an infectious disease.
13. Draw labelled diagrams showing the parts of the human male and female reproductive systems.
14. In humans, where are the ova and sperm produced?
15. Describe the process leading to fertilisation of an ovum by a sperm.
16. What happens in IVF?
17. Discuss the use of IVF.

Glossary

receptor, sensory nerve, motor nerve, effector, reflex action, endocrine, hormone, gland, immune system, antibody, reproductive, ovum, ovary, oviduct, uterus, vagina, sperm, testes, vas deferens, semen, zygote, in vitro fertilisation (IVF)

School Certificate 2010

1) Multiple Choice

- i) Where in the human body does a fertilised egg implant?
- (A) Testes
(B) Urethra
(C) Uterus
(D) Vagina

ii) Which of the following describes the way a body responds to infectious diseases?

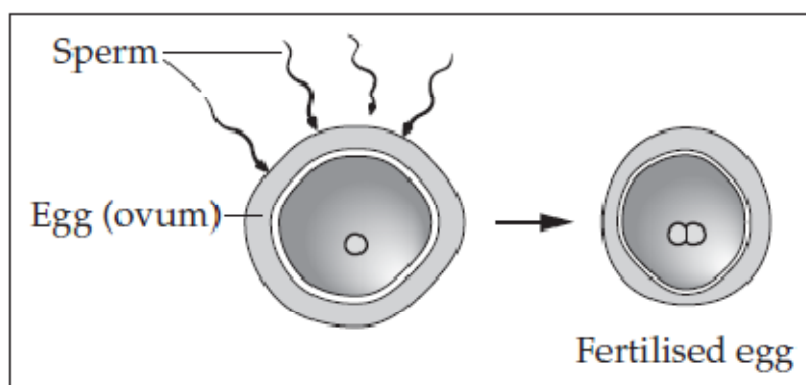
- (A) Cells divide to replace damaged cells.
- (B) Chemicals known as hormones are released into the bloodstream from glands.
- (C) Specialised cells filter out disease-causing microorganisms.
- (D) White blood cells engulf and digest invading microorganisms.

iii) What does the data in Table 1, Source B of the Stimulus Booklet show?

- (A) The number of cases of Type 1 diabetes steadily increased.
- (B) The number of cases of Type 2 diabetes decreased.
- (C) The number of cases of Type 2 diabetes increased.
- (D) The number of other cases remained constant.

2) **One Word Answers**

i) In which part of the female human reproductive system does the process shown below usually occur?



School Certificate 2009

1) **Multiple Choice**

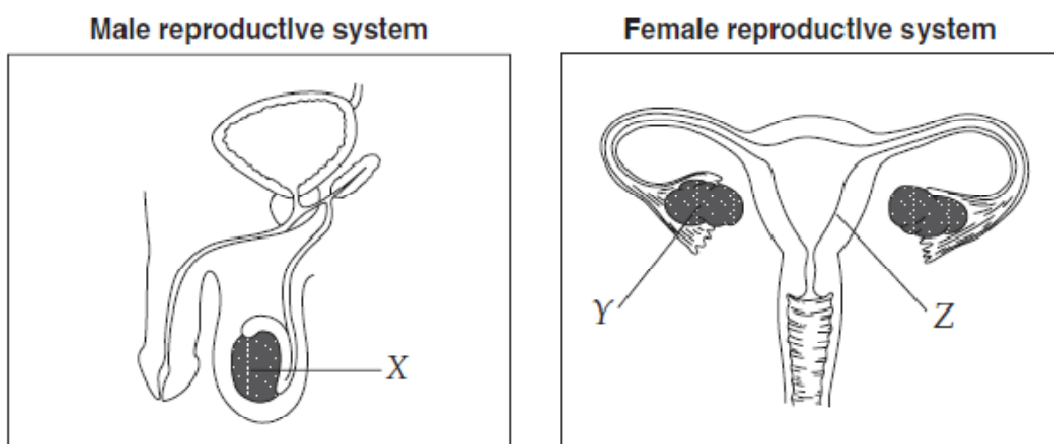
i) Which option correctly describes what happens to salts in the body?

	<i>Salts enter the blood from</i>	<i>Salts are removed from the blood in</i>
(A)	Small intestine	Bladder
(B)	Large intestine	Bladder
(C)	Small intestine	Kidney
(D)	Large intestine	Kidney

2) **Short Answer Questions**

- i) There are two systems involved in coordinating the functioning of the human body. Describe the role that each of these systems plays in maintaining humans as functioning organisms

The diagram shows the human reproductive systems.



- ii) Complete the table for the organs labelled X and Y.

	<i>Name of organ</i>	<i>One function that both organs X and Y perform</i>
X		
Y		

- iii) Identify the organ labelled Z and describe its reproductive function

School Certificate 2008

1) **Multiple Choice**

- i) What type of disease is melanoma?

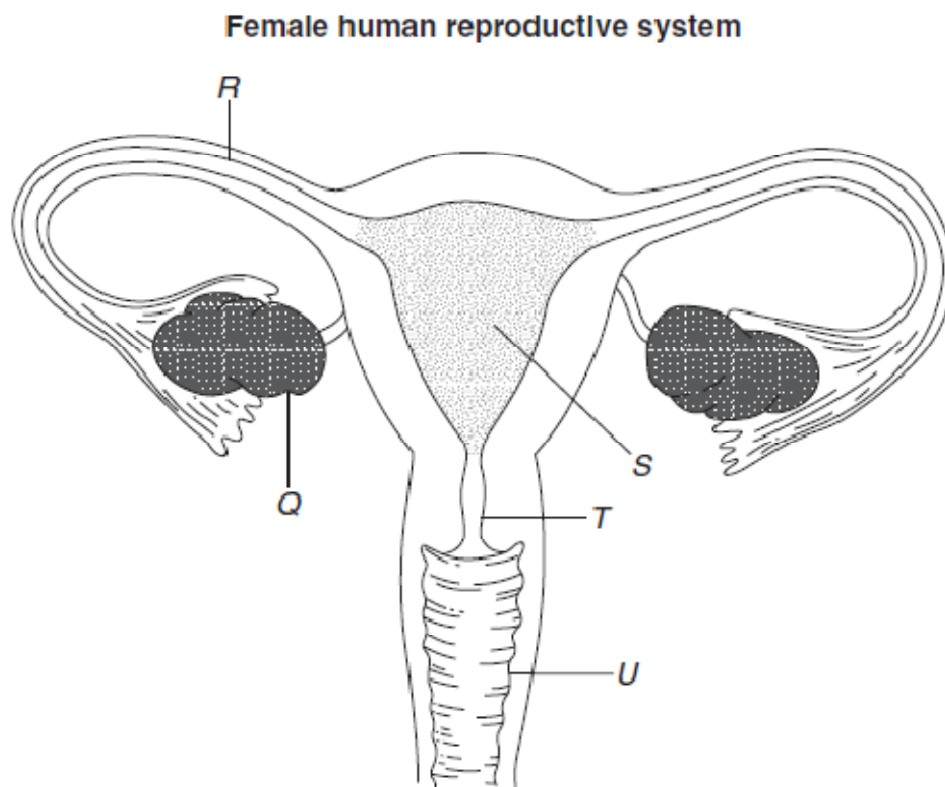
- (A) Immune
- (B) Infectious
- (C) Non-infectious
- (D) Reproductive

ii) In which organ are sperm produced?

- (A) The penis
- (B) The prostate gland
- (C) The scrotum
- (D) The testes

2) **One word Answers**

Use the diagram to answer the next two questions



i) Which letter correctly labels the ovary?

ii) Which letter correctly labels the site where the embryo develops?

1) **Multiple Choice**

i)

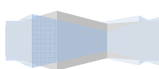
Adrenaline is a chemical substance that is secreted into the bloodstream by the adrenal glands in our body. Adrenaline acts as a chemical messenger involved in coordination. The chemical formula of adrenaline is $C_9H_{13}NO_3$.

What term best describes this substance?

- (A) Hazardous
 - (B) Hormone
 - (C) Inorganic
 - (D) Synthetic
- ii) In the coordination system of the human body, which of the following interact with each other?
- (A) Brain and lungs
 - (B) Heart and nerves
 - (C) Eyes and muscles
 - (D) Hormones and nerves
- iii) (Refer to stimulus booklet to answer the question)

What type of disease could cane toads transmit to native frogs?

- (A) Infectious
- (B) Hormonal
- (C) Reproductive
- (D) Non-infectious



School Certificate 2006

1) **Multiple Choice**

- i) When Europeans first settled in Australia, many Aboriginal people died from smallpox and influenza infections. These diseases did not affect the Europeans as severely.

What is the best explanation for this?

- (A) Aboriginal people did not have a natural defence against these diseases.
(B) The Aboriginal lifestyle made them more susceptible than the Europeans to these diseases.
(C) The Aboriginal population were not given the same vaccinations as the Europeans to protect them from these diseases.
(D) The Aboriginal population had not developed resistance to these diseases because they had not been previously exposed to them.

2) **One word Answers**

- i) In which part of the human female reproductive system are eggs stored?

3) **Short Answer Questions**

Read the information below about iodine.

Iodine is an important element both for healthy humans and the chemical industry. The thyroid gland in our necks uses iodine to make a hormone called thyroxine. The blood carries thyroxine to all parts of our bodies.

Thyroxine affects the way our cells work. Adults can become unwell through a lack of iodine in the diet. Iodine can come from the soil but richer sources of iodine are seafoods and dairy products. Also some brands of table salt have iodine added to them.

The main source of iodine in the chemical industry is sea water. Iodine can be manufactured by reacting chlorine gas with sodium iodide (the salt) from sea water.

- i) State the role of hormones in the human body.
ii) Write a word equation for the reaction that produces iodine.
iii) Iodine deficiency is an example of a non-infectious disease. Why is iodine deficiency classified as *non-infectious*?

Scientists have identified a lack of iodine in the diet of many Australians.

- iv) Propose a possible cause for this lack of iodine in the diet.
- v) Describe how the mass media could assist in solving this problem

School Certificate 2005

1) **Multiple Choice**

- i) Coordination in humans is controlled by the nervous and hormonal systems.

Which of the following statements about these systems is correct?

- (A) They both act at the same speed.
- (B) They always act independently.
- (C) They may interact to produce a response.
- (D) They both use chemicals carried in the blood

2) **One word Answers**

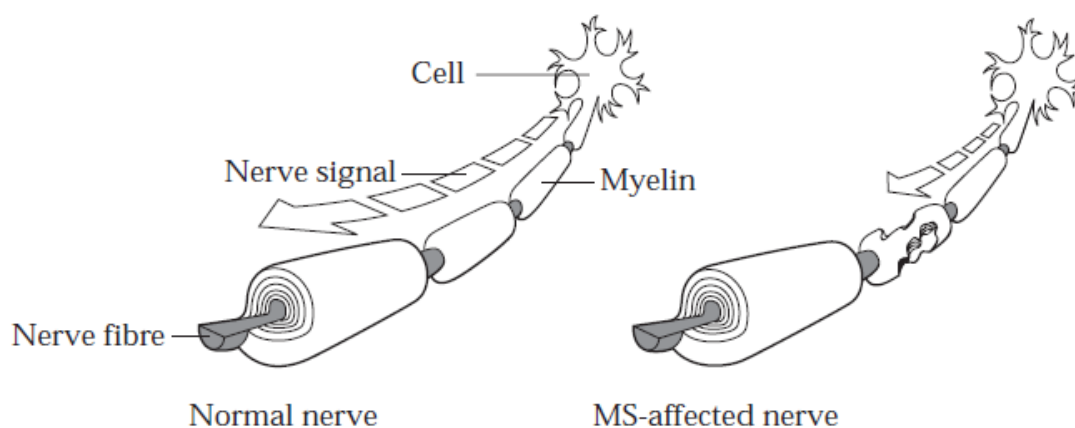
- i) Some diseases are caused by organisms such as bacteria and fungi. These can be transmitted in various ways through the environment.

What term do biologists use to describe this group of diseases?

School Certificate 2004

1) **Multiple Choice**

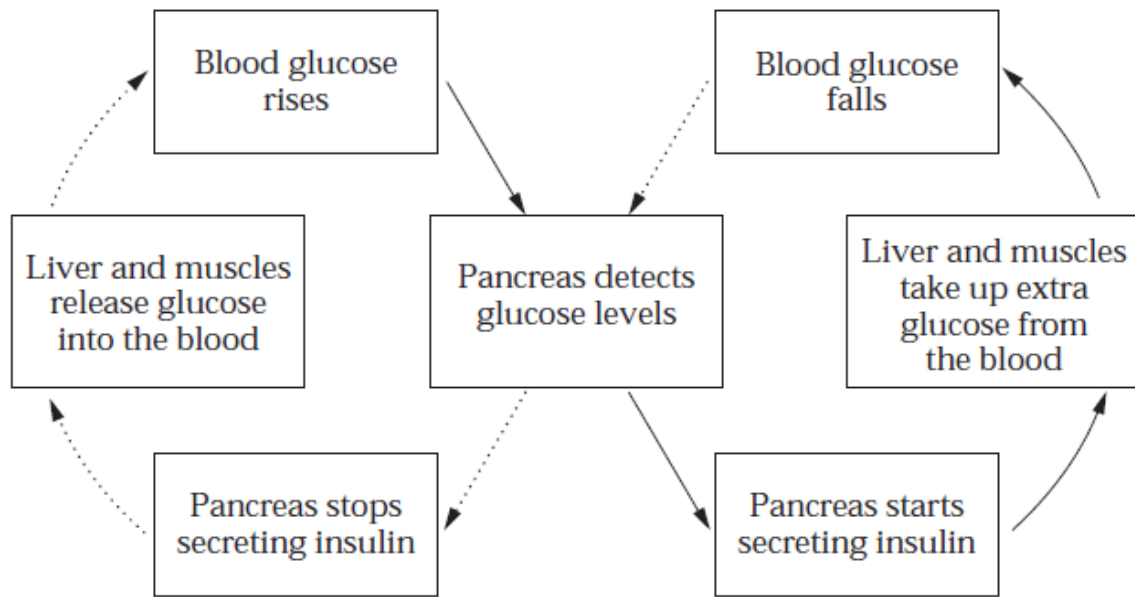
- i) Multiple sclerosis (MS) is a disease where the transmission of nerve signals through the body is disrupted.



From the diagram, what happens to a nerve when a person has MS?

- (A) The cell is enlarged.
 - (B) The myelin is damaged.
 - (C) The nerve fibre is damaged.
 - (D) The nerve signal travels in the opposite direction.
- ii) Scientists have developed a new model to explain the way a human body responds to a non-infectious disease.
What would scientists do to verify this new model?
- (A) Compare the old model with the new one.
 - (B) Reject the old model and replace it with the new one.
 - (C) Make predictions using the new model and test them.
 - (D) Use the new model to research an infectious disease
- iii) The human body's coordination is controlled by the nervous and the hormonal systems. Which statement best describes how these systems work?
- (A) The nervous system and the hormonal system work independently of each other.
 - (B) The nervous system coordinates slow reactions and the hormonal system coordinates fast reactions.
 - (C) The nervous system and the hormonal system work together to make responses to the environment.
 - (D) The nervous system coordinates the body during the day and the hormonal system coordinates the body during the night.
- iv) Why does the human body need to protect itself from diseases?
- (A) Diseases cause evolutionary change.
 - (B) Infectious diseases always enter the body through the skin.
 - (C) Diseases disrupt the normal functioning of a person's body.
 - (D) All non-infectious diseases can be passed easily from one person to another person.

- v) The diagram represents a process that occurs in the human body.



What happens when the pancreas detects a drop in blood glucose levels?

- (A) The pancreas starts secreting insulin.
- (B) The pancreas stops secreting insulin.
- (C) The liver and muscles remove glucose from the blood.
- (D) More glucose is produced by the pancreas.

2) **Short Answer Questions**

Construct a table to show which of the following reproductive organs are female and which are male:

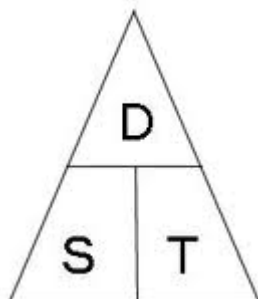
ovary, urethra, Fallopian tube, cervix, testis, prostate gland, vagina

Motion

Distance, Speed And Time

The distance travelled by an object is equal to its average speed multiplied by the time it takes to travel the distance.

distance d	=	average speed v_{av}	x	time t
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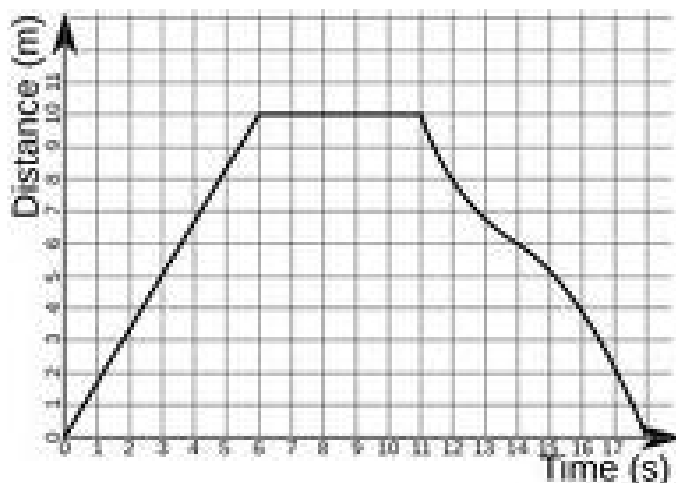
Average speed is the total distance travelled by an object divided by the time it takes to go that distance.

average speed = v_{av}	=	distance travelled d	time taken t
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Distance is measured in metres (m), average speed in metres per second (m/s) and time in seconds (s).

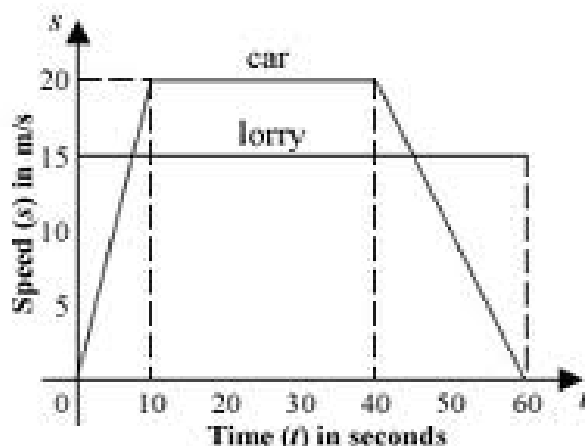
Distance – Time Graphs

Distance – time graphs show the distance travelled by a person or object as time passes. The slope of the line in any section of the graph is the speed of the person or object in that period of time.



Speed – Time Graphs

Speed-time graphs show the speed of a person or object as time passes. The slope of the line in any section of the graph is the acceleration of the person or object in that period of time.



Acceleration And Force

Acceleration is a change in speed eg, speeding up, slowing down, starting, stopping, and/or a change in direction.

A force is needed to change the speed and direction of an object, that is, a force causes acceleration.

Inertia And Newton's First Law Of Motion

Inertia is the tendency of an object to stay at rest or keep moving at the same speed in the same direction. For example, if you are standing in a moving bus and it suddenly stops you will keep moving forwards because of your inertia.

Newton's First Law of Motion states "Unless a force acts on it, a stationary object will stay at rest and a moving object will continue to move at the same speed in the same direction."

Cars have technology to oppose inertia and so protect passengers from injury and death.

For example, when a car stops suddenly, the seat belt stops the passenger from moving forwards. In cases where the passenger moves forwards, the air bag stops them from hitting the windscreen or steering wheel. A head restraint works in the opposite way. When a car is hit from behind, the head restraint stops the passenger's head from moving backwards.

WITH NO OUTSIDE FORCES
THIS OBJECT WILL
NEVER MOVE



WITH NO OUTSIDE FORCES
THIS OBJECT WILL
NEVER STOP



Newton's Second Law Of Motion

Newton's Second Law of Motion states "The acceleration of an object is determined by its mass and the force acting on it" and is defined by the equation

Force	=	mass	x	acceleration
F	=	m	x	a

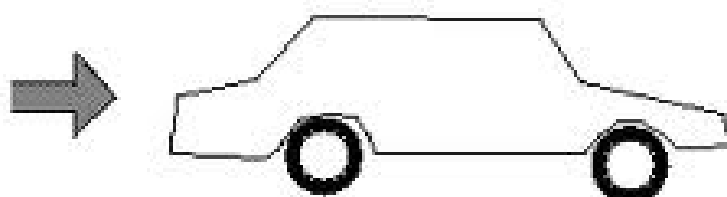
Force is measured in Newtons (N), mass in kilograms (kg) and acceleration in metres per second per second (m/s^2).

This law means that the larger the mass then the larger the force needed to accelerate it, that is change its speed. For example, it is easier to push a small vehicle than a large one, large trucks accelerate slowly from traffic lights.

Same force small mass: large acceleration



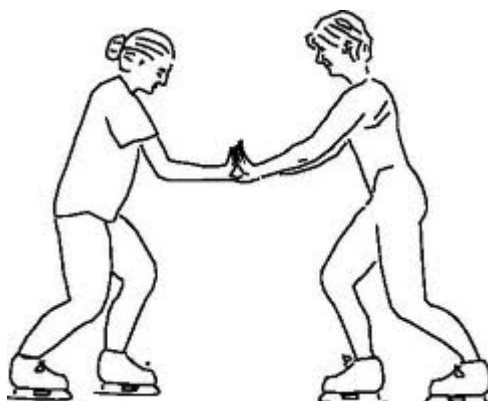
large mass: small acceleration



Force = mass x acceleration

Newton's Third Law Of Motion

Newton's Third Law of Motion states "For every force there is an equal and opposite force." For example, when a gun fires a bullet, it pushes the bullet forwards. The bullet then pushes backwards on the gun with the same force. The burning fuel in a rocket engine pushes hot exhaust gases out of the rocket. As this happens, the gases push on the inside of the rocket forcing it upwards.



Gravity, Mass And Weight

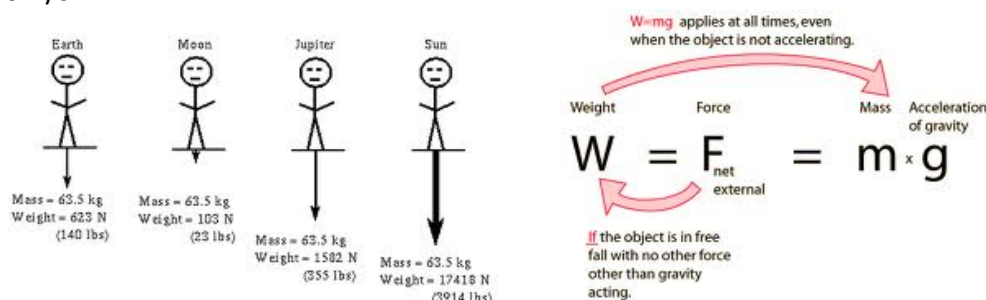
Gravity is the force that pulls all objects down towards the centre of the earth. All objects in the universe have their own gravity. Gravity keeps artificial satellites in orbit around earth, keeps planets in orbit around the sun and stops the air in the atmosphere around earth from escaping into space.

The **mass** of an object is defined as the amount of matter in an object. It is measured in kilograms (kg) or grams (g) on a beam balance. The **weight** of an object is defined as the force of gravity pulling down on the object. It is measured in Newtons (N) on a spring balance. **g** is the acceleration due to gravity and on earth it is equal to 9.8 metres per second per second (9.8m/s^2). On the moon, **g** is equal to 1.6m/s^2 .

The weight of an object is equal to its mass multiplied by the acceleration due to gravity.

Weight	=	mass	x	acceleration due to gravity
W	=	m	x	g

An object on the moon has the same mass as it has on earth but less weight because **g** is less on the moon. Out in space objects have mass but are weightless because **g** is equal to 0m/s^2 .



Study Questions

- Using an example, explain the relationship between distance, average speed and time.
- A car travels at an average speed of 90km/h for 2.5h. Using the equation $d = vt$, calculate the distance travelled by the car.
- What is acceleration?
- What is the relationship between acceleration and force?
- What does Newton's First Law of Motion state?
- Using an example, describe one effect of inertia.
- Identify one safety feature in a car and explain how it opposes inertia to protect passengers from injury and death.
- What does Newton's Second Law of Motion state?
- A truck of mass 10 000kg accelerates from traffic lights at 2m/s^2 . Using the equation $F=ma$, calculate the force required to cause this acceleration.
- Using an example, explain the difference between "mass" and "weight".
- What does Newton's Third Law of Motion state?
- Describe one example of Newton's Third Law of Motion.
- What is the difference between "mass" and "weight"?
- Using the equation $w=mg$, calculate the weight of a 50kg person on
 - Earth where $g = 10$
 - the Moon where $g = 1.6$.

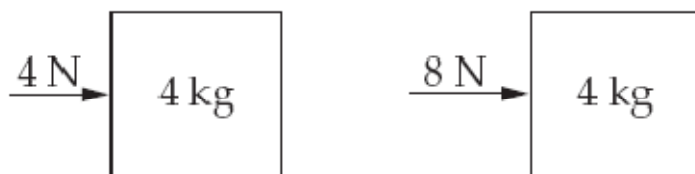
Glossary

acceleration, force, Newton, inertia, mass, weight

School Certificate 2010

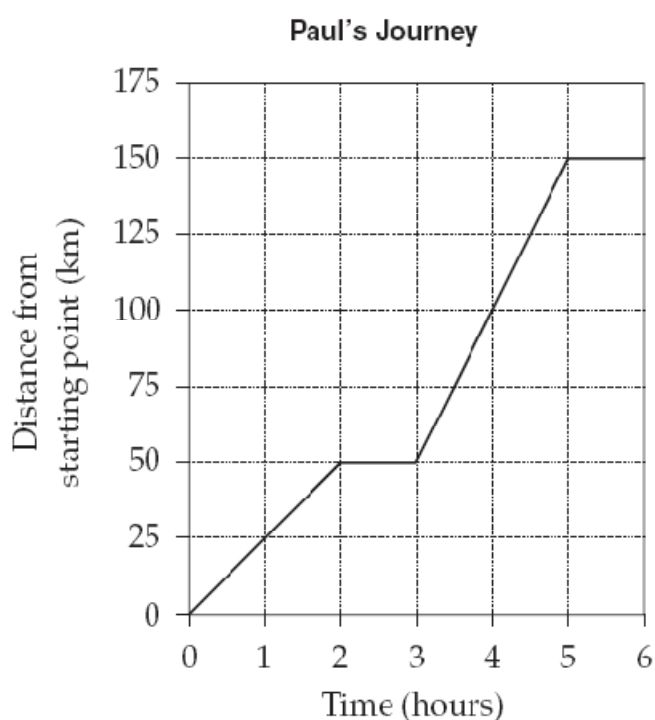
1) Multiple Choice

- i) What will happen to the acceleration of an object if the force acting on it is doubled?



- (A) It will increase.
- (B) It will decrease.
- (C) It will stay the same.
- (D) It will change direction.

- ii) The graph represents a journey that Paul took in his car.



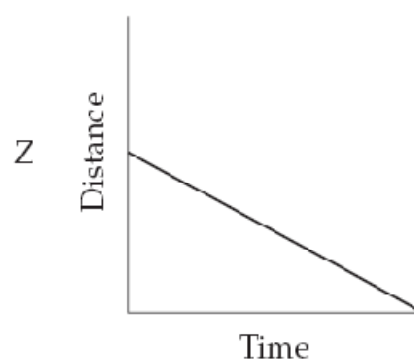
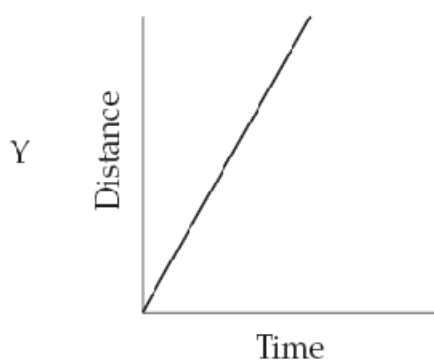
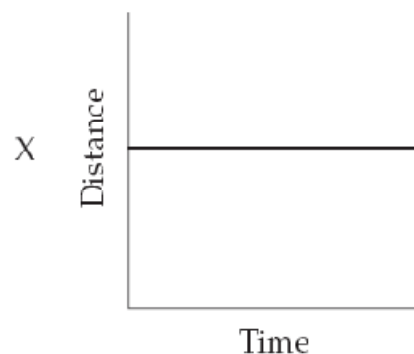
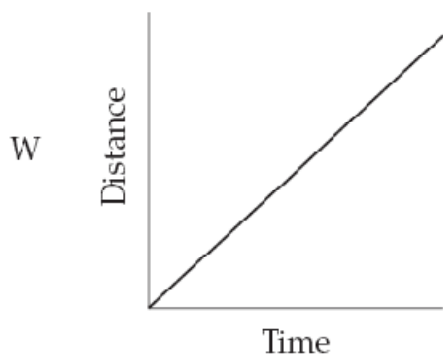
164

How far did Paul travel in the first three hours?

- (A) 0 km
- (B) 25 km
- (C) 50 km
- (D) 150 km

Use the graphs below to answer the next two questions.

The graphs represent four different journeys made by a trolley.



iii) Which graph represents the trolley travelling at the fastest speed?

- (A) W
- (B) X
- (C) Y
- (D) Z

iv) Which graph represents the trolley being stationary?

- (A) W
- (B) X
- (C) Y
- (D) Z

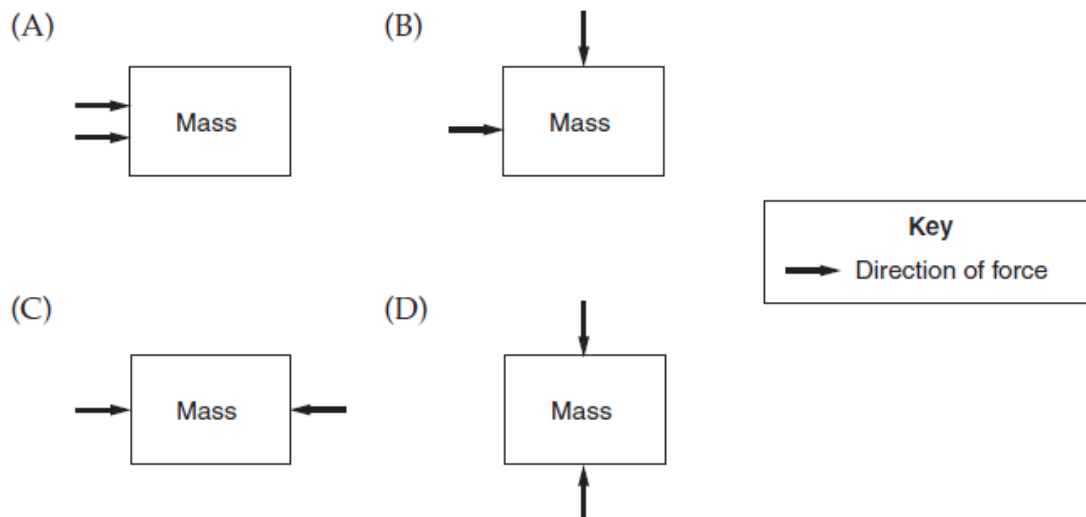
v) What term describes the amount of matter in an object?

- (A) Gravity
- (B) Force
- (C) Mass
- (D) Weight

1) **Multiple Choice**

- i) The diagrams show two equal forces acting on a 10 kg mass in different ways.

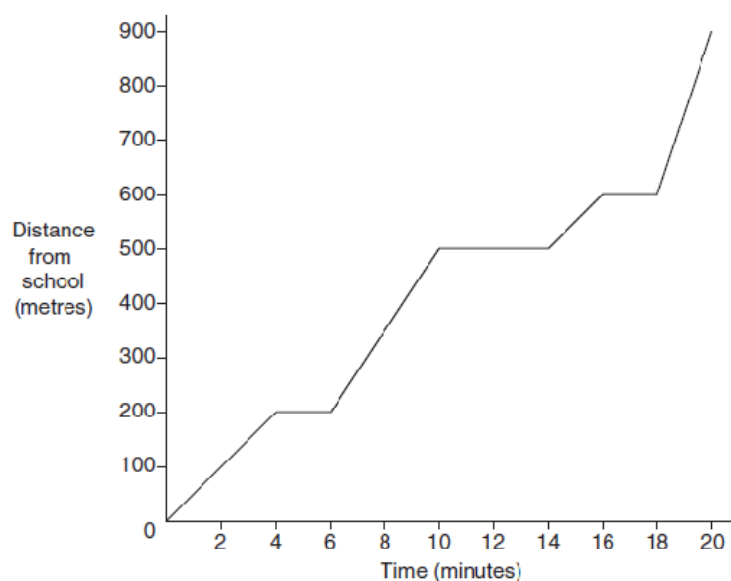
Which arrangement of forces will lead to the greatest acceleration of the 10 kg mass?



2) **One word Answers**

Refer to the following graph to answer Questions i) to iii).

The graph represents a student's progress walking from school to home over 20 minutes.

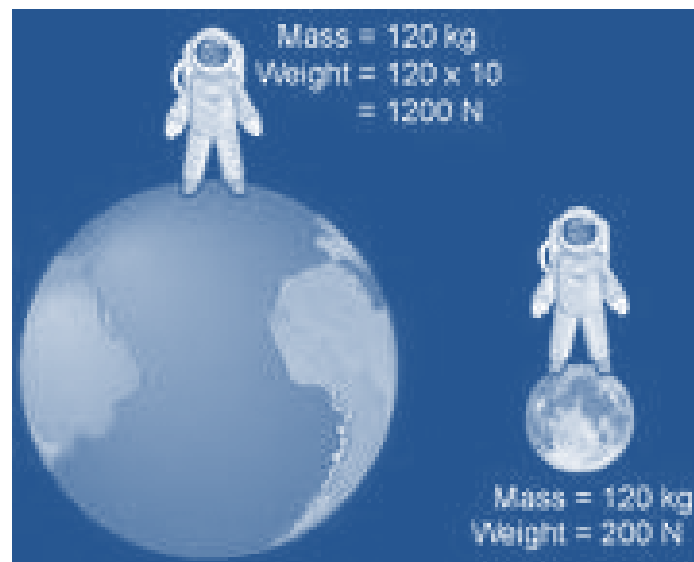


- i) How many metres did the student travel to get home?
- ii) How many times did the student stop during the journey?
- iii) What was the student's average speed for the first 4 minutes in metres per minute?

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

2) **Short Answer Questions**

- i) The diagrams illustrate the effect of gravity on a 70 kg astronaut on the Moon and on Earth. The size of the arrows is an indication of the difference in gravity (newtons) at each place.



This is not the exact picture as its still awaiting copyright – only difference however is the mass of astronaut is 120kg instead of 70 kg

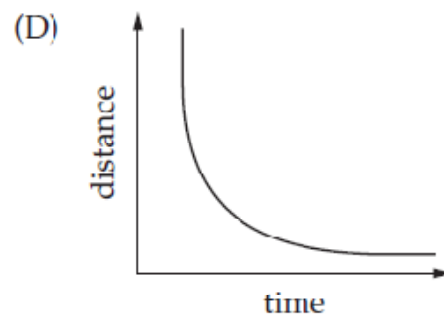
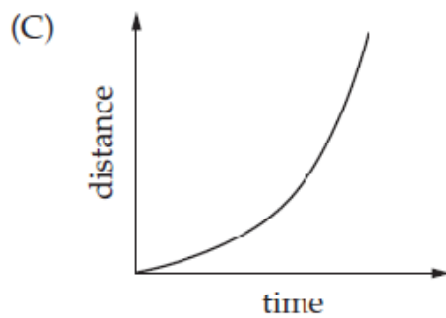
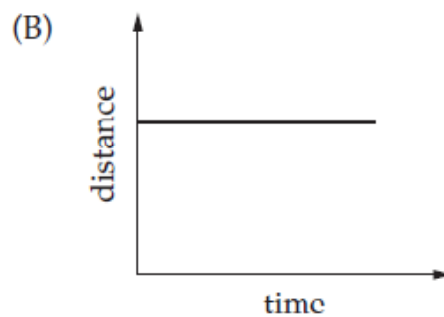
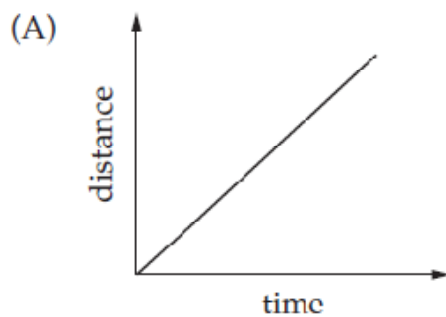
Referring to the diagram, distinguish between the terms *mass* and *weight*.

1) **Multiple Choice**

i) A person on Earth has a mass of 100 kg. What would their mass be on the moon?

- (A) 100 kg
- (B) Less than 100 kg
- (C) More than 100 kg
- (D) This cannot be predicted.

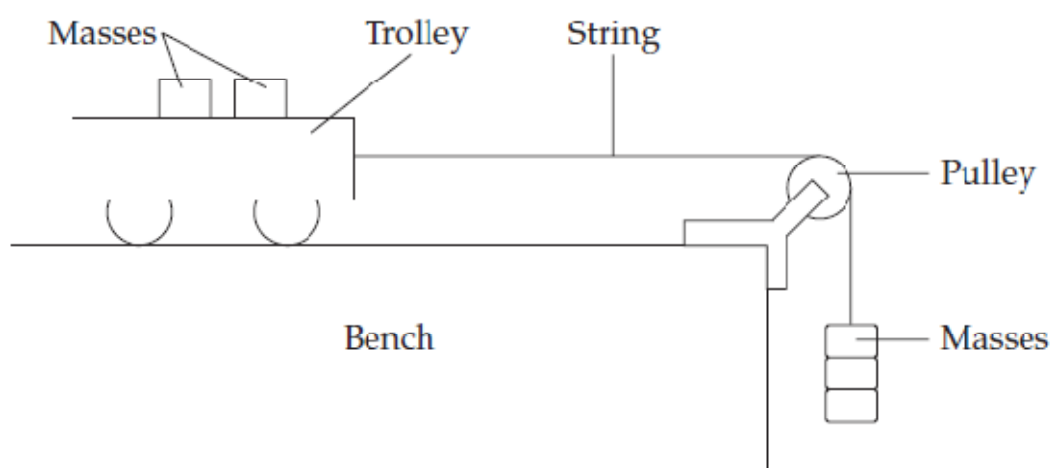
ii) A car is moving in a straight line at a constant speed. What would the correct distance versus time graph look like?



1) **Multiple Choice**

Use the information to answer Questions i) and ii)

A student wanted to investigate how the acceleration of a trolley was affected by the mass of the trolley. He set up the trolley on a bench and used masses hung over a pulley to provide a force on the trolley.



- i) Which variable should the student change during the experiment?
- (A) The number of masses carried on the trolley
 - (B) The number of masses hanging from the pulley
 - (C) The distance that the trolley travels along the bench
 - (D) The distance that the masses hang below the pulley
- ii) The student measured how long it took the trolley to travel from rest along the bench.
- How would his measurements be related to the acceleration of the trolley?
- (A) If the time decreased, the acceleration would halve.
 - (B) If the time increased, the acceleration would increase.
 - (C) If the time increased, the acceleration would decrease.
 - (D) If the time decreased, the acceleration would be constant.

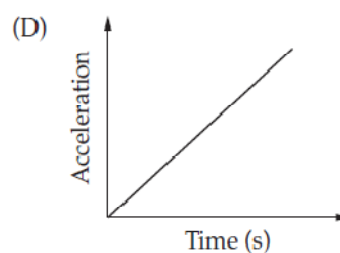
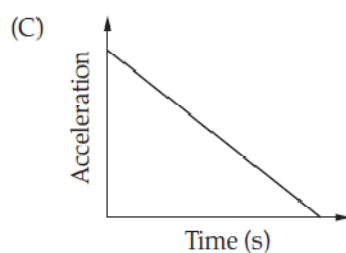
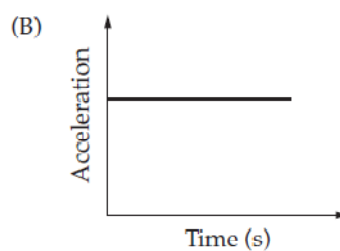
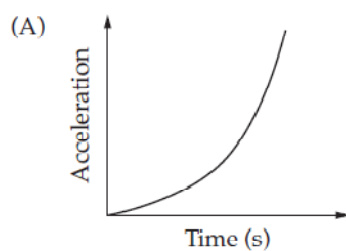
- iii) The skateboard rider shown in the time-lapse photograph is performing an 'ollie'.



During this mid-air move the skater is able to manipulate his legs so that the board appears to stick to his feet.

Which scientific principle appears to have been broken?

- (A) Acceleration
 - (B) Conservation of mass
 - (C) Gravity
 - (D) Wave motion
- iv) A ball is rolled down a smooth slope and its acceleration is measured.
Which graph shows the acceleration of the ball?



2) **Short Answer Questions**

Refer to Source *D* in the Stimulus Booklet to answer question i) to iii)

- i) What is the effect of atmospheric drag on the speed of a satellite?
- ii) Explain why a satellite in conditions represented by line *Y* has a shorter lifetime than a satellite in conditions represented by line *X*.
- iii) Draw arrows on the diagram to show:
 - the direction of the atmospheric drag force (label this arrow A)
 - the direction of the satellite's weight (label this arrow B)
 - the direction of the acceleration caused by the drag force (label this arrow C).

Awaiting copyright

School Certificate 2006

1) **Multiple Choice**

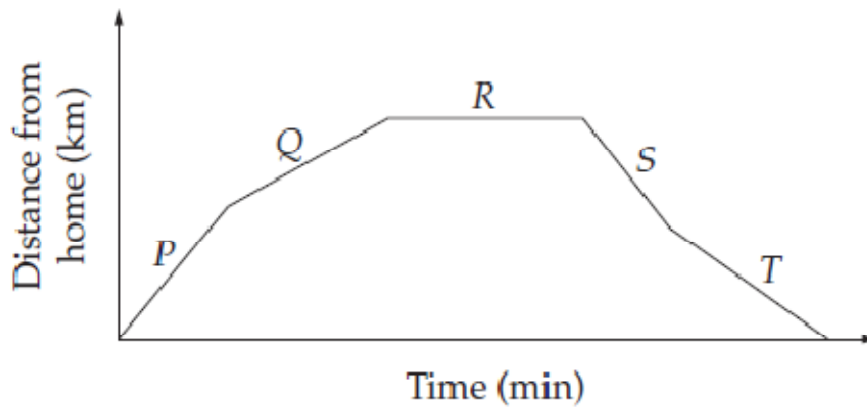
- i) An aeroplane's mass will decrease during a flight as it uses fuel in its engine.

Which statement describes the speed of the aeroplane during the flight if the force from the engine remains constant?

- (A) The speed will increase.
- (B) The speed will decrease.
- (C) The speed will remain constant.
- (D) The speed will decrease, then increase.

Use the graph to answer Questions ii) and iii).

The graph shows the motion of a car as it travels through the city streets.



- ii) Which section of the graph shows when the car is stationary?
- (A) *P*
 - (B) *Q*
 - (C) *R*
 - (D) *S*
- iii) Which sections of the graph show when the car was returning home?
- (A) *P* and *Q*
 - (B) *P* and *R*
 - (C) *R* and *S*
 - (D) *S* and *T*

2) **One word Answers**

- i) What is the name given to the change in speed and/or direction of an object?

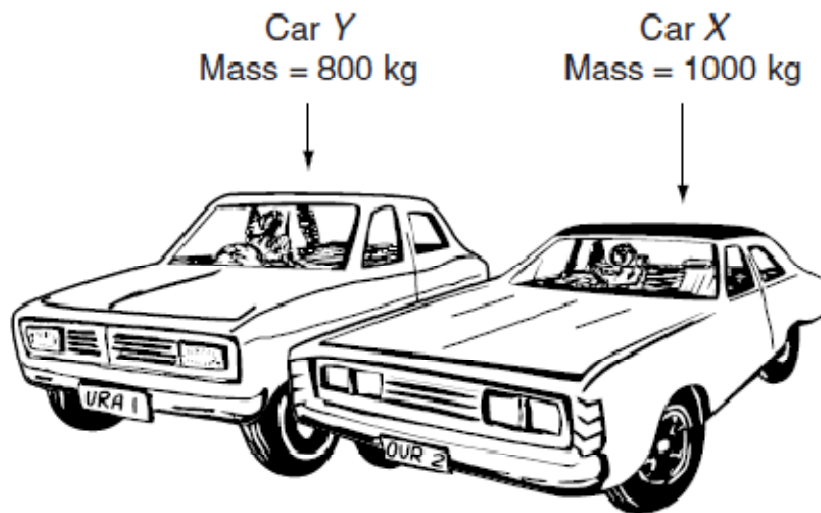
1) **Multiple Choice**

- i) The weight and mass of an object are measured on the Moon and on Earth. The Moon has less gravity than Earth.

Which of the following statements is correct?

- (A) The object's mass is greater on the Moon.
- (B) The object's mass is smaller on the Moon.
- (C) The object's weight is greater on the Moon.
- (D) The object's weight is smaller on the Moon

- ii) Two cars taking part in a race are lined up at the starting line.



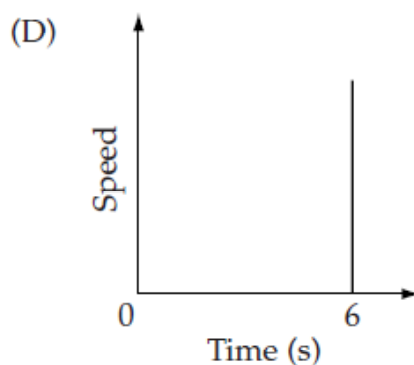
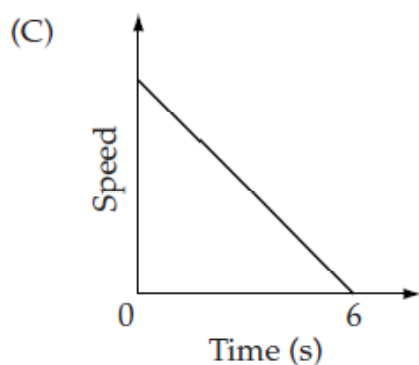
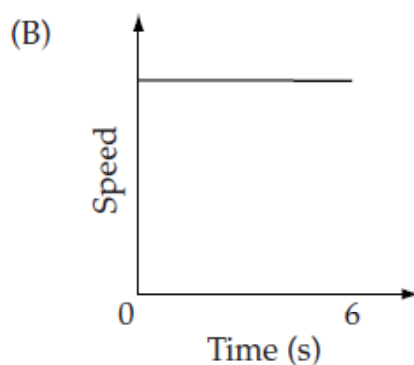
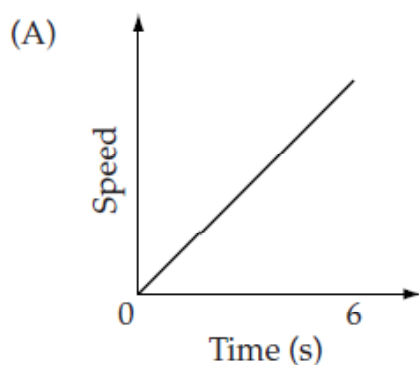
When the starter begins the race, the forces supplied to both cars are equal.

What is the best way to describe the acceleration of each car?

- (A) Car Y should accelerate more than car X because car Y has less mass.
- (B) Car X should accelerate more than car Y because car X has greater mass.
- (C) Both cars should accelerate equally because they both start at the same time.
- (D) Both cars should accelerate equally because they are both experiencing the same force.

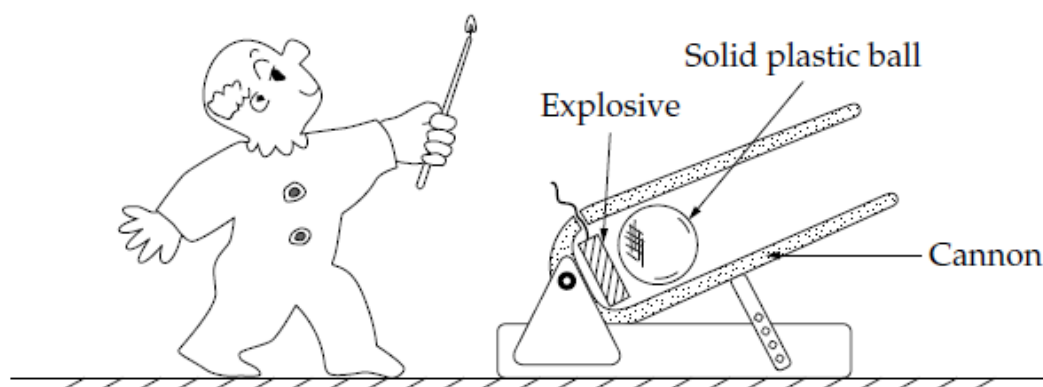
- iii) A constant force acting on a moving trolley brings it to a stop in 6 seconds.

Which graph shows the motion of the trolley during the 6 seconds?



2) **Short Answer Questions**

Chico is a clown. In his act, he fires a solid plastic ball from a small cannon.



Chico wants the ball to travel further. He cannot use a different cannon but there are other things he can change. In the following table, list two things that Chico can change and explain why each change would make the ball travel further.

<i>What could be changed?</i>	<i>Why would the ball travel further?</i>

School Certificate 2004

1) **Multiple Choice**

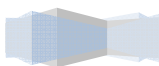
Use the following information to answer Questions i) and ii).

Phan and Erika carried out an experiment using a remote-controlled car travelling in a straight line. The table shows the students' experimental results.

<i>Time (seconds)</i>	<i>Total distance travelled (metres)</i>
0	0
10	10
20	15
30	20
40	25
50	25

- i) Which of the following is the best piece of equipment to measure distance in this experiment?

- (A) Stopwatch
- (B) 30 cm ruler
- (C) Metre ruler
- (D) 50 m tape measure

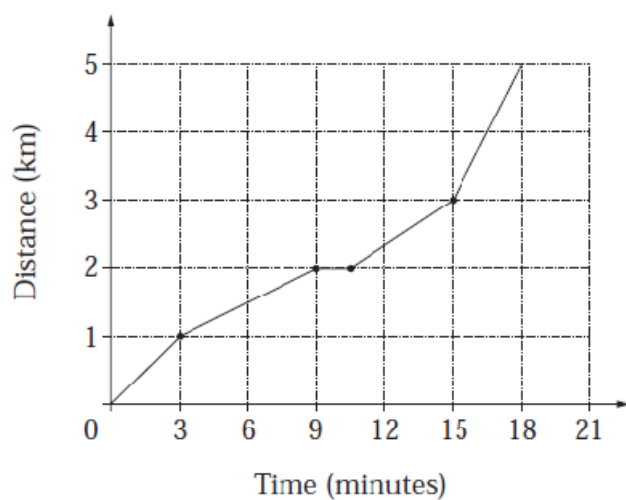


- ii) Phan and Erika used their results to calculate the speed of the car. What units should they use for speed?

- (A) Metres
- (B) Metres per second
- (C) Seconds
- (D) Square metres

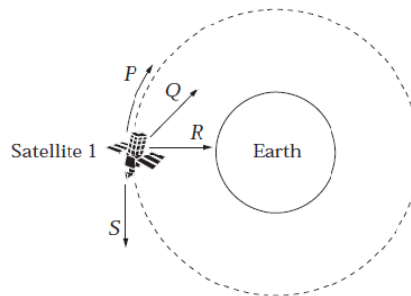
Use the graph to answer Questions iii) – v)

The graph represents Tristan's journey as he rode his bicycle from his house to his friend's house.



- iii) How far is it from Tristan's house to his friend's house?
- (A) 2 km
 - (B) 5 km
 - (C) 9 km
 - (D) 18 km
- iv) Tristan stopped for a rest during the ride. For how long did he stop?
- (A) 1 minute
 - (B) 1.5 minutes
 - (C) 2 minutes
 - (D) 9 minutes
- v) Between which times was Tristan travelling fastest?
- (A) 0–9 minutes
 - (B) 9–10.5 minutes
 - (C) 10.5–15 minutes
 - (D) 15–18 minutes

Use the diagram to answer Questions vi – x)



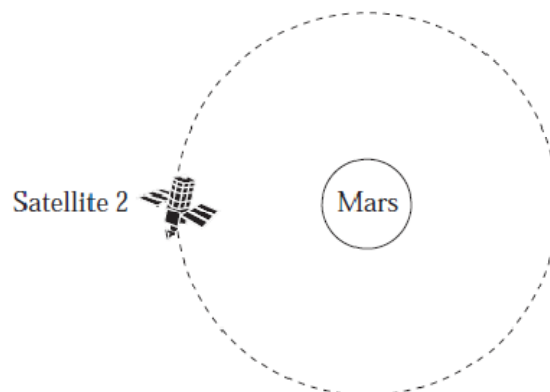
vi) Which arrow, *P*, *Q*, *R* or *S*, shows the direction of the force of gravity on Satellite 1?

- (A) *P*
- (B) *Q*
- (C) *R*
- (D) *S*

vii) Which of the following does NOT affect the size of the force of gravity on Satellite 1?

- (A) Mass of Earth
- (B) Mass of Satellite 1
- (C) Distance between Earth and Satellite 1
- (D) Speed at which Satellite 1 is travelling.

viii) An identical satellite is orbiting Mars. Both satellites are the same distance from the centre of the planet that they orbit. Mars has a mass that is approximately 10% of Earth's mass.



ix) Which statement correctly compares the force of gravity on the two satellites?

- (A) The force on Satellite 2 is equal to the force on Satellite 1.
- (B) The force on Satellite 2 is larger than the force on Satellite 1.
- (C) There is no force on Satellite 2 but a large force on Satellite 1.
- (D) The force on Satellite 2 is smaller than the force on Satellite 1.

x) Which statement about mass and weight is correct?

- (A) Your mass would be the same on Earth and Mars.
- (B) Your weight would be the same on Earth and Mars.
- (C) Your mass would be less on Mars than on Earth.
- (D) Your weight would be more on Mars than on Earth.

xi) Harry hit a cricket ball with a force of 10 newtons. What was the force of the ball on the bat?

	<i>Size of force (newtons)</i>	<i>Direction of force</i>
(A)	10	away from bat
(B)	10	towards bat
(C)	Greater than 10	away from bat
(D)	Greater than 10	towards bat

Chemical Reactions

Types of Chemical Reactions?

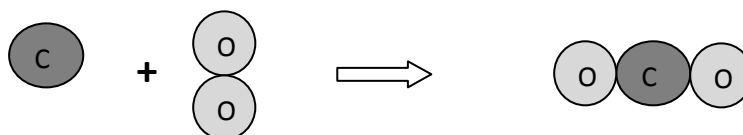
1) **Combination Reactions**

In combination reactions, two or more substances combine to form one new substance.

These reactions have the general equation:



For example: one carbon atoms combines with two oxygen atoms to form carbon dioxide.



2) **Decomposition Reactions**

Decomposition reactions are the opposite of combination reactions. One substance breaks down into two or more new substances.

These reactions have a general equation:

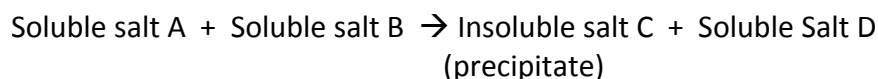


Examples are:

- i) Calcium carbonate \rightarrow Calcium oxide + Carbon dioxide
- ii) Magnesium hydroxide \rightarrow Magnesium oxide + water

3) **Precipitation Reactions**

Precipitation reactions result in an insoluble solid (precipitate) being formed when two clear liquids are mixed.



Solubility of substances help in determining whether a precipitate will occur.
Nitrates ARE ALL SOLUBLE.

Sodium salts ARE ALL SOLUBLE

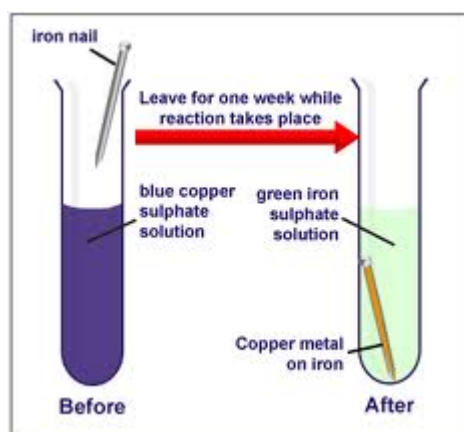
4) Displacement Reactions

Different metals have different degrees of reactivity. Some metals give up their outer shell electrons very easily and are therefore **very reactive**. The alkali metals (Group 1) are the most reactive metals. Other metals, like silver and gold are very **unreactive**. This means they don't give up their outer electrons easily.

potassium	most reactive	K
sodium		Na
calcium		Ca
magnesium		Mg
aluminium		Al
carbon		C
zinc		Zn
iron		Fe
tin		Sn
lead		Pb
hydrogen		H
copper		Cu
silver		Ag
gold		Au
platinum	least reactive	Pt

When one metal deposits on another, the reaction is known as a **displacement reaction**. If you have a solution of a particular metal salt, and you place a solid piece of a more reactive metal in the solution, a reaction will take place. The electrons from the more reactive metal will be transferred to the ions of the less reactive metal which will become a solid and deposit on the surface of the more reactive metal.

“A more reactive metal will displace a less reactive metal in solution”



Glossary

Precipitation, displacement, combination, decomposition, activity series

School Certificate 2010

1) **Multiple Choice**

- i) During the electrolysis of water the gases hydrogen and oxygen are produced. The equation for this reaction is shown:



What type of reaction is this?

- (A) Oxidation
(B) Combustion
(C) Neutralisation
(D) Decomposition
- ii) A precipitation reaction occurs when two substances that are dissolved in water react and form a substance that does not dissolve in water. This substance is called a precipitate. The table shows which dissolved substances form a precipitate when combined. These substances exist as dissolved ions.

	<i>Chloride</i>	<i>Hydroxide</i>	<i>Nitrate</i>	<i>Carbonate</i>
<i>Sodium</i>	X	X	X	X
<i>Magnesium</i>	X	X	X	P
<i>Calcium</i>	X	X	X	P
<i>Lead</i>	X	P	X	P
<i>Silver</i>	P	P	X	P

Key X – No precipitate P – Precipitate formed

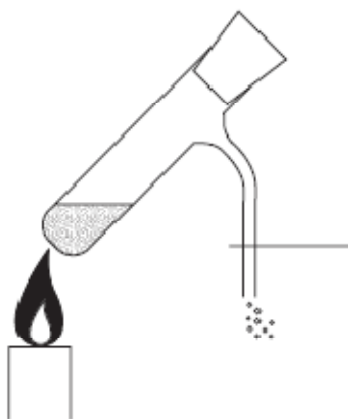
Which of the following substances does NOT dissolve in water?

- (A) Lead nitrate
(B) Magnesium hydroxide
(C) Silver carbonate
(D) Sodium chloride
- iii) What is the chemical formula of calcium carbonate?

- (A) CCO_3
(B) CaCO_3
(C) Ca_3CO
(D) CaCO_2

1) **Multiple Choice**

Use the following information to answer the next two questions.
A student heated some copper carbonate in a test tube as shown.



The student wrote the following notes in their note book.

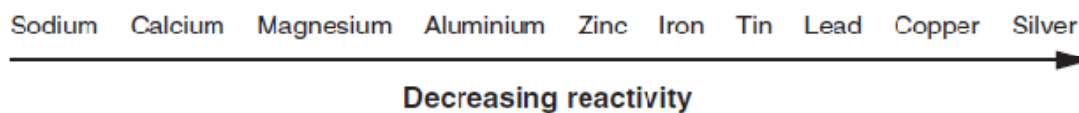
- 1 The solid changed colour from green to black.
- 2 Carbonates release carbon dioxide gas when heated.
- 3 The gas collected turned limewater a milky colour.
- 4 The black solid must be carbon.

- i) Which statement about the notes is correct?
- (A) Note 2 is a hypothesis.
(B) Note 4 is an observation.
(C) Notes 1 and 4 are conclusions.
(D) Notes 1, 2 and 3 are observations.
- ii) Why is the reaction called a decomposition reaction?
- (A) Heat is required.
(B) Carbon dioxide is produced.
(C) Two substances combine to form a larger molecule.
(D) One reactant breaks down into two or more products

School Certificate 2008

1) **Multiple Choice**

- i) The scale shows the reactivity of various metals



Which metal is more reactive than lead but less reactive than aluminium?

- (A) Copper
- (B) Magnesium
- (C) Sodium
- (D) Tin

School Certificate 2007

1) **Short Answer Questions**

(Refer to stimulus booklet to answer the question below)

- i) Write a word equation for the heating of copper carbonate shown in the flow chart.

School Certificate 2006

1) **Short Answer Questions**

Source A in the Stimulus Booklet shows some of the equipment referred to in this question. Brendan conducted an investigation in which he:

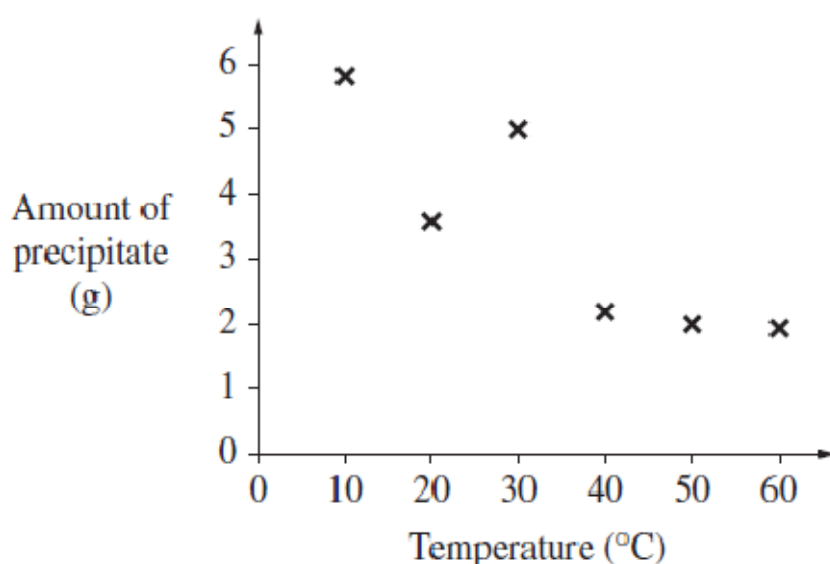
- mixed two solutions
 - filtered the precipitate which formed
 - placed some of the solid into a crucible (labelled *N*)
 - heated the crucible with a Bunsen burner (labelled *M*) to dry the solid.
- i) Explain why the crucible (labelled *N*) is a more appropriate choice than a beaker (labelled *P*) to dry the solid.

Brendan then wanted to know if the temperature at which the two solutions were mixed affected the amount of precipitate produced.

In the table, list the variable(s) he should keep the same and those that he should change, in order to conduct the investigation.

<i>Variables</i>	
<i>Keep the same</i>	<i>Change</i>
.....
.....

ii) Brendan produced a graph of results from his investigation



State a conclusion that Brendan could draw from the results of his investigation.

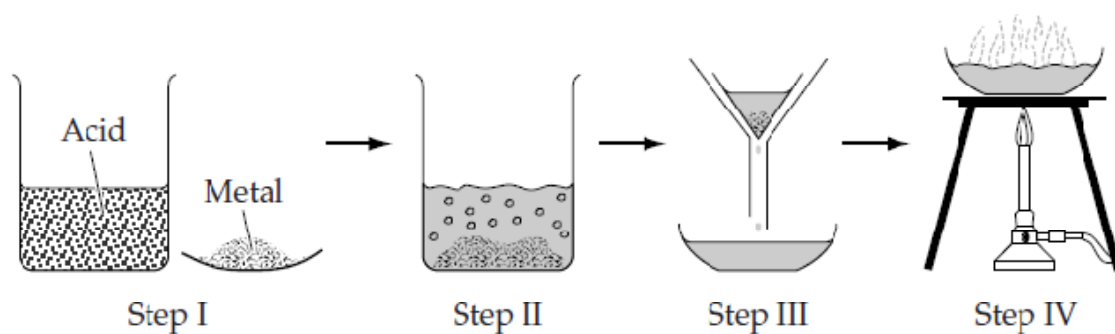
iii) Brendan explained to another student that he was concerned about the accuracy of his data at 30°C.

State a possible cause for the result at 30°C.

iv) Brendan's teacher said that the precipitate was not to be washed down the sink when he cleaned up after conducting his investigations.

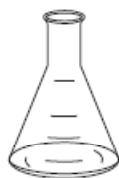
Suggest a reason for the teacher's instruction.

Use this diagram to answer Questions i) – iii).



- i) In which step would new substances be formed?
- (A) Step I
(B) Step II
(C) Step III
(D) Step IV
- ii) When evaporation is complete after Step IV, what substance would remain in the dish?
- (A) Acid
(B) Metal
(C) Salt
(D) Water
- iii) Which piece of equipment would be most suitable to use instead of a beaker in Step II?

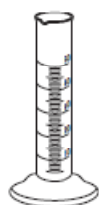
(A)



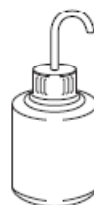
(B)



(C)



(D)



Use the information provided to answer Questions iv) – v)

When sodium chloride solution is added to potassium nitrate solution, no solid products are formed. However, when lead nitrate solution is added to sodium iodide solution, a yellow solid forms.

- iv) What is the name of the type of chemical reaction that produces the yellow solid?
- (A) Corrosion
 - (B) Decomposition
 - (C) Neutralisation
 - (D) Precipitation
- v) What is the yellow solid formed?
- (A) Lead iodide
 - (B) Potassium chloride
 - (C) Sodium nitrate
 - (D) Sulfur

